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**U.S. PATENT AND TRADEMARK OFFICE  
PROVISIONAL APPLICATION FOR PATENT COVER SHEET**

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT  
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| INVENTOR(S)/APPLICANT(S) |            |    |                                                      |
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**TITLE OF THE INVENTION (280 characters max)**

DIAGNOSIS OF HYPERINSULINEMIA AND TYPE II DIABETES AND PROTECTION AGAINST SAME BASED ON GENES DIFFERENTIALLY EXPRESSED IN MUSCLE CELLS

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**ENCLOSED APPLICATION PARTS (check all that apply)**

☒ Specification      Number of Pages      261      ☒ Applicant claims small entity status. See 37 C.F.R. §1.27  
☐ Drawing(s)      Number of Sheets      ☐ Other (specify) \_\_\_\_\_

**METHOD OF PAYMENT (check one)**

☒ Credit Card Payment Form PTO-2038 is enclosed to cover the Provisional filing fee of  
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No ☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

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**DIAGNOSIS OF HYPERINSULINEMIA AND TYPE II DIABETES AND  
PROTECTION AGAINST SAME BASED ON GENES DIFFERENTIALLY  
EXPRESSED IN MUSCLE CELLS**

*Cross-Reference to Related Applications*

5 In US Prov. Appl. 60/460,415, filed April 7, 2003  
(KOPCHICK6-USA), differential hybridization techniques were  
used to identify mouse genes that are differentially  
expressed in mouse liver, depending upon their development  
of hyperinsulinemia or type II diabetes.

10 In essence, complementary RNA derived from normal mice,  
or mouse models of hyperinsulinemia or type II diabetes, was  
screened for hybridization with oligonucleotide probes each  
specific to a particular mouse gene, each gene in turn  
representative of a particular mouse gene cluster (Unigene).

15 To obtain the mouse models, some mice were fed a high-  
fat diet, and then monitored for the development of  
hyperinsulinemia (elevated plasma insulin levels but normal  
fasting blood-glucose levels) or type II diabetes (both  
elevated plasma insulin and fasting blood glucose levels).  
20 Gene expression 2, 4, 8 and 16 weeks after commencement of  
the diet was analyzed.

The oligonucleotide probes were provided by the  
Codelink Uniset Mouse I Bioarray (Amersham, product code  
300013). Amine-terminated oligonucleotide probes are  
25 attached to a three-dimensional polyacrylamide gel matrix (a  
"gene chip"). There are 10,000 oligonucleotide probes,  
each specific to a well-characterized mouse gene. Each  
mouse gene is representative of a unique gene cluster from  
the fourth quarter 2001 Genbank Unigene build.

30 Mouse genes which were differentially expressed (normal  
vs. hyperinsulinemic, hyperinsulinemic vs. diabetic, or  
normal vs. diabetic), as measured by different levels of  
hybridization of the respective cRNA samples with the  
particular probe corresponding to that mouse gene) were  
35 identified. Related human genes and proteins were  
identified by sequence comparisons to the mouse gene or  
protein.

A later application added 6 month expression data, see



US Prov. Appl. 60/506,716, filed Sept. 30, 2003  
(Kopchick6.1-USA).

5 In a similar manner, in U.S. Provisional Appl. Ser. No.  
60/517,376 filed November 6, 2003 (our docket Kopchick12-  
USA), we describe the identification of mouse genes  
differentially expressed (normal vs. hyperinsulinemic,  
hyperinsulinemic vs. diabetic, or normal vs. diabetic) in  
pancreas, and of cognate human genes and proteins.

10 In U.S. Provisional Appl. Ser. No. 60/458,398 (our  
docket Kelder1-USA), filed March 31, 2003, we describe the  
identification of genes differentially expressed in normal  
vs. hyperinsulinemic, hyperinsulinemic vs. type II diabetic,  
15 or normal vs. type II diabetic mouse liver. Forward- and  
reverse-subtracted cDNA libraries were prepared, clones  
were isolated, and differentially expressed cDNA inserts  
were sequenced and compared with sequences in publicly  
available sequence databases. The corresponding mouse and  
20 human genes and proteins were identified.

The use of differential hybridization to identify genes  
and proteins is also described in our Ser. No.  
PCT/US00/12145 (Kopchick 3A-PCT), Ser. No. PCT/US00/12366  
(Kopchick4A-PCT), Ser. No. 60/400,052 (Kopchick5), and Ser.  
25 No. 60/485,222 (Kopchick8).

None of the above applications examined muscle  
expression.

30 All of the above applications are incorporated by  
reference in their entirety.

## BACKGROUND OF THE INVENTION

### 35 Field of the Invention

The invention relates to various nucleic acid molecules  
and proteins, and their use in (1) diagnosing  
hyperinsulinemia and type II diabetes, or conditions

associated with their development, and (2) protecting mammals (including humans) against them.

### Description of the Background Art

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#### **Diabetes**

A deficiency of insulin in the body results in diabetes mellitus, which affects about 18 million individuals in the United States. It is characterized by a high blood glucose (sugar) level and glucose spilling into the urine due to a deficiency of insulin. As more glucose concentrates in the urine, more water is excreted, resulting in extreme thirst, rapid weight loss, drowsiness, fatigue, and possibly dehydration. Because the cells of the diabetic cannot use glucose for fuel, the body uses stored protein and fat for energy, which leads to a buildup of acid (acidosis) in the blood. If this condition is prolonged, the person can fall into a diabetic coma, characterized by deep labored breathing and fruity-odored breath.

There are two types of diabetes mellitus, Type I and Type II. Type II diabetes is the predominant form found in the Western world; fewer than 8% of diabetic Americans have the type I disease.

25

*Type I diabetes.* In Type I diabetes, formerly called juvenile-onset or insulin-dependent diabetes mellitus, the pancreas cannot produce insulin. People with Type I diabetes must have daily insulin injections. But they need to avoid taking too much insulin because that can lead to insulin shock, which begins with a mild hunger. This is quickly followed by sweating, shallow breathing, dizziness, palpitations, trembling, and mental confusion. As the blood sugar falls, the body tries to compensate by breaking down fat and protein to make more sugar. Eventually, low blood sugar leads to a decrease in the sugar supply to the brain, resulting in a loss of consciousness. Eating a sugary food can prevent insulin shock until appropriate medical measures

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can be taken.

Type I diabetics are often characterized by their low or absent levels of circulating endogenous insulin, i.e., hypoinsulinemia (1). Islet cell antibodies causing damage to the pancreas are frequently present at diagnosis. Injection of exogenous insulin is required to prevent ketosis and sustain life.

*Type II diabetes.* Type II diabetes, formerly called adult-onset or non-insulin-dependent diabetes mellitus (NIDDM), can occur at any age. The pancreas can produce insulin, but the cells do not respond to it.

Type II diabetes is a metabolic disorder that affects approximately 17 million Americans. It is estimated that another 10 million individuals are "prone" to becoming diabetic. These vulnerable individuals can become resistant to insulin, a pancreatic hormone that signals glucose (blood sugar) uptake by fat and muscle. In order to maintain normal glucose levels, the islet cells of the pancreas produce more insulin, resulting in a condition called hyperinsulinemia. When the pancreas can no longer produce enough insulin to compensate for the insulin resistance, and thereby maintain normal glucose levels, hyperglycemia (elevated blood glucose) results, and type II diabetes is diagnosed.

Early Type II diabetics are often characterized by hyperinsulinemia and resistance to insulin. Late Type II diabetics may be normoinsulinemic or hypoinsulinemic. Type II diabetics are usually not insulin dependent or prone to ketosis under normal circumstances.

Little is known about the disease progression from the normoinsulinemic state to the hyperinsulinemic state, and from the hyperinsulinemic state to the Type II diabetic state.

As stated above, type II diabetes is a metabolic disorder that is characterized by insulin resistance and impaired glucose-stimulated insulin secretion (2,3,4). However, Type II diabetes and atherosclerotic disease are

viewed as consequences of having the insulin resistance syndrome (IRS) for many years (5). The current theory of the pathogenesis of Type II diabetes is often referred to as the "insulin resistance/islet cell exhaustion" theory.

5 According to this theory, a condition causing insulin resistance compels the pancreatic islet cells to hypersecrete insulin in order to maintain glucose homeostasis. However, after many years of hypersecretion, the islet cells eventually fail and the symptoms of clinical  
10 diabetes are manifested. Therefore, this theory implies that, at some point, peripheral hyperinsulinemia will be an antecedent of Type II diabetes. Peripheral hyperinsulinemia can be viewed as the difference between what is produced by the  $\beta$  cell minus that which is taken up by the liver.  
15 Therefore, peripheral hyperinsulinemia can be caused by increased  $\beta$  cell production, decreased hepatic uptake or some combination of both. It is also important to note that it is not possible to determine the origin of insulin resistance once it is established since the onset of  
20 peripheral hyperinsulinemia leads to a condition of global insulin resistance.

Multiple environmental and genetic factors are involved in the development of insulin resistance, hyperinsulinemia and type II diabetes. An important risk factor for the  
25 development of insulin resistance, hyperinsulinemia and type II diabetes is obesity, particularly visceral obesity (6,7,8). Type II diabetes exists world-wide, but in developed societies, the prevalence has risen as the average age of the population increases and the average individual  
30 becomes more obese.

*Obesity and Diabetes.* Obesity is a serious and growing problem in the United States. Obesity-related health risks include high blood pressure, hardening of the arteries,  
35 cardiovascular disease, and Type II diabetes (also known as non-insulin-dependent diabetes mellitus, Type II diabetes) (9,10,11). Recent studies show that 85% of the individuals with Type II diabetes are obese (12).

*Treatment of Diabetes.* For many years, treatment was insulin therapy for Type I and oral sulfonylureas and/or insulin therapy for Type II. Metformin (glucophage) was the first antidiabetic drug approved by FDA (May 1995) for the treatment of Type II diabetes since the oral sulfonylureas were introduced in 1984. Metformin promotes the use of insulin already in the blood. This May 1995 approval was followed by the September 1995 approval of another antidiabetic drug, Acarbose (precose). It slows down the digestion and absorption of complex sugars, which reduces blood sugar levels after meals.

Before 1982, insulin was purified from beef or pork pancreas. This was a problem for those diabetics allergic to animal insulin. Researchers produced a synthetic insulin called humulin. Approved by FDA in 1982, it was the first genetically engineered consumer health product manufactured for diabetics. Synthetic insulins can be produced in unlimited quantities.

Another possible treatment for diabetes includes surgically replacing the pancreas' endocrine tissues (islets of Langerhans) with healthy islet of Langerhans tissue grafts. Since 1988, 45 patients worldwide have undergone successful transplantation.

*Complications.* Complications of diabetes (end organ damage) include retinopathy, neuropathy, and nephropathy (traditionally designated as microvascular complications) as well as atherosclerosis (a macrovascular complication). Early stages of hyperglycemia can usually be controlled by an alteration in diet and increasing the amount of exercise, but drug treatment, including insulin, may be required. It has been shown that meticulous blood glucose control can often slow down or halt the progression of diabetic complications if caught early enough (1). However, tight metabolic control is extremely difficult to achieve.

## Animal Models

*Transgenic Mouse Models of Diabetes or Diabetes Resistance.* McGrane, et al., J. Biol. Chem. 263:11443-51 (1988) and Chen, et al., J. Biol. Chem., 269:15892-7 (1994) describe the genetic engineering of mice to express bovine growth hormone (bGH) or human growth hormone (hGH), respectively. These mice exhibited an enhanced growth phenotype. They also developed kidney lesions similar to those seen in diabetic glomerulosclerosis, see Yang, et al., Lab. Invest., 68:62-70 (1993). Ogueta, et al., J. Endocrinol., 165: 321-8 (2000) reported that transgenic mice expressing bovine GH develop arthritic disorder and self-antibodies.

Growth hormone has many roles, ranging from regulation of protein, fat and carbohydrate metabolism to growth promotion. GH is produced in the somatrophic cells of the anterior pituitary and exerts its effects either through the GH-induced action of IGF-I, in the case of growth promotion, or by direct interaction with the GHR on target cells including liver, muscle, adipose, and kidney cells. Hyposecretion of GH during development leads to dwarfism, and hypersecretion before puberty leads to gigantism. In adults, hypersecretion of GH results in acromegaly, a clinical condition characterized by enlarged facial bones, hands, feet, fatigue and an increase in weight. Of those individuals with acromegaly, 25% develop type II diabetes. This may be due to insulin resistance caused by the high circulating levels of GH leading to high circulating levels of insulin (Kopchick et al., Annual Rev. Nutrition 1999. 19:437-61).

A further mode of GH action may be through the transcriptional regulation of a number of genes contributing to the physiological effects of GH.

Growth hormone genes and the proteins encoded by them can be converted into growth hormone antagonists by mutation, see Kopchick USP 5,350,836. Transgenic mice have been made that express the GH antagonists bGH-G119R or hGH

G120R, and which exhibit a dwarf phenotype. Chen, et al., J. Biol. Chem., 263:15892-7 (1994); Chen, et al., Mol. Endocrinol, 5:1845-52 (1991); Chen, et al., Proc. Nat. Acad. Sci. USA 87:5061-5 (1990). These mice did not develop  
 5 kidney lesions. See Yang (1993), supra.

Chen, et al., Endocrinol, 136:660-7 (1995) compared the effect of streptozotocin treatment in normal nontransgenic mice, and in mice transgenic for (1) a GH receptor antagonist, the G119R mutant of bovine growth hormone or (2)  
 10 the E117L-mutant of bGH. (According to Chen's ref. 24, these large GH transgenic streptozotocin-treated mice constitute an animal model for diabetes.) Glomerulosclerosis was seen in diabetic (STZ-treated) nontransgenic mice and in diabetic bGH-E117L mice, but not in diabetic bGH-G119R (GH  
 15 antagonist) mice.

Two of the proteins which mediate growth hormone activity are the growth hormone receptor and the growth hormone binding protein, encoded by the same gene in mice(GHR/BP). It is possible to genetically engineer mice  
 20 so that the gene encoding these proteins is disrupted ("knocked-out"; inactivated), see Zhou, et al., Proc. Nat. Acad. Sci. (USA), 94:13215-20 (1997). Zhou, et al. inactivated the GHR/BP gene by replacing the 3' portion of exon 4 (which encodes a portion of the GH binding domains)  
 25 and the 5' region of intron 4 with a neomycin gene cassette. The modified gene was introduced into the target mice by homologous recombination. Like mice expressing a GH antagonist, homozygous GHR/BP-KO mice exhibit a dwarf phenotype. GHR/BP-KO mice, made diabetic by streptozotocin  
 30 treatment, are protected from the development of diabetes-associated nephropathy. Bellush, et al., Endocrinol., 141:163-8 (2000).

*High-Fat Diets.* High-fat diets have been shown to  
 35 induce both obesity and Type II diabetes in laboratory animals (13). Surwit and colleagues demonstrated that male C57BL/6J mice are extremely sensitive to the diabetogenic effects of a high-fat diet when initiated at weaning. At

six months of age, high-fat fed animals had significantly elevated fasting blood-glucose and insulin levels and also demonstrated a decrease in insulin sensitivity (14). Ahren and colleagues (15) reported evidence of insulin resistance as well as diminished glucose-stimulated insulin release, after feeding with a high-fat diet for 12 weeks. These mice also showed elevated levels of total cholesterol, triglycerides, and free fatty acids, another hallmark of Type II diabetes.

### **Anatomy and Physiology of Muscle**

Muscle tissue constitutes about 40% of the body mass.

Muscles may be classified by location, i.e., skeletal if attached to bone, cardiac if forming the wall of the heart, and visceral if associated with another body organ. Muscles may also be classified as voluntary or involuntary, depending on how their contractions and relaxations are controlled. Skeletal muscles are voluntary, while cardiac and visceral muscles are involuntary. It is also possible to classify muscles morphologically; skeletal and cardiac muscle cells are striated, whereas visceral muscle cells are not.

Each skeletal muscle is composed of many individual muscle cells called muscle fibers. The fibers are held together by fibrous connective-tissue membranes called fascia. The fascium which envelops the entire muscle is the epimysium, and the fascia which penetrate the muscle, separating the fibers into bundles (fasciculi) are called perimysium. Very thin fascia (endomysium) sheath each muscle fiber. Skeletal muscles are attached either directly to a bone, or indirectly through a tendon.

The individual muscle fibers (cells) comprise threadlike protein structures called myofibrils.

There are over 600 muscles in the human body. We will have



occasion later to refer to the gastrocnemius. It is a superficial muscle in the posterior compartment of the lower leg, which together with the underlying soleus forms the characteristic bulge of the calf.

5

### **Role of Muscle in Development of Type II Diabetes**

Muscle, fat and liver tissues are the major contributors to the development of insulin resistance, hyperinsulinemia, and, ultimately, type II diabetes.

10

Muscle cells respond to insulin by increasing glucose uptake from the bloodstream. Muscle tissue can become resistant to insulin, causing the beta cells to initially increase insulin secretion. Eventually, though, the beta cells become unable to compensate for this increasing insulin resistance from muscle and other cells, and they fail to respond to elevated blood glucose levels. Thus, clinical type 2 diabetes results from the combination of insulin resistance and impaired beta cell function.

15

20

Defects in muscle glycogen synthesis are known to play a role in the development of insulin resistance. At least three steps-those mediated by glycogen synthase, hexokinase, and GLUT4-have been reported to be defective in patients with type 2 diabetes.

25

Fatty acids can induce insulin resistance, and it has been suggested that this was a consequence of altered insulin signaling through PI3-kinase. PKC- $\theta$  has also been implicated.

30

See generally Petersen, et al., "Pathogenesis of Skeletal muscle insulin resistance in type 2 diabetes mellitus", in "A Symposium: Evolution of type 2 diabetes mellitus management", at *Amer. J. Cardiol.*, 90(5A): 11G-18G, (Sept. 5, 2002).

35

### **Adverse Effects of Type II Diabetes on Muscle**

"Myopathy is a general term used to describe any disease of muscles, such as the muscular dystrophies and myopathies associated with thyroid disease. It can be caused

by endocrine disorders, including diabetes, metabolic disorders, infection or inflammation of the muscle, certain drugs and mutations in genes. In diabetes, myopathy is thought to be caused by neuropathy, a complication of diabetes. General symptoms of myopathies include muscle weakness of limbs sometimes occurring during exercise although in some cases the symptoms diminish as exercise increases. Depending on the type of myopathy, one muscle group may be more affected than others." See "Joint and Muscle Problems Associated with Diabetes", [www.iddtinternational.org/jointandmuscleproblems.html](http://www.iddtinternational.org/jointandmuscleproblems.html) [Last modified June 12, 2003].

Diabetic muscle infarction can spontaneously affect patients with a long history of poorly controlled diabetes. "Most affected patients have multiple microvascular complications (neuropathy, nephropathy, and retinopathy). The clinical presentation is an acute onset of pain and swelling over days to weeks in the affected muscle groups (usually the thigh or calf), along with varying degrees of tenderness.... Therapy consists of rest and analgesia. Routine daily activities are not deleterious to the condition, but physical therapy may cause exacerbation. Spontaneous diabetic muscle infarction tends to resolve over a period of weeks to months in most cases." See "Musculoskeletal Complications of Diabetes - Part 2", [www.diabetic-lifestyle.com/articles/jan02\\_whats\\_1.htm](http://www.diabetic-lifestyle.com/articles/jan02_whats_1.htm) [last modified Feb. 9, 2004]. See also Trujillo-Santos, et al., "Diabetes muscle infarction: an underdiagnosed complication of long-standing diabetes," *Diabetes Care*, 26(1):211-5 (2003).

### **Identification of genes involved in hyperinsulinemia and type II diabetes, generally**

5           Our attention recently has focused on the generation of muscle mRNA expression profiles and the identification of genes involved in the genesis of the obesity-induced hyperinsulinemia and type-II diabetes. To date, no one has attempted to study the actual progression from the normal  
10           condition to that of hyperinsulinemia or from hyperinsulinemia to Type II diabetes in an attempt to identify genes that are up-regulated or down-regulated in muscle as the disease progresses.

          In previous studies aimed at identifying genes involved  
15           in diabetes-induced glomerulosclerosis, differential display and traditional subtractive hybridization techniques were used (16-20). While effective for the identification of a few genes (e.g. hmunc13, PED/PEA-15, lactate dehydrogenase, amiloride sensitive sodium channel, ubiquitin-like protein,  
20           mdr 1, and a-amyloid protein precursor as well as a few novel genes), these techniques can be quite labor intensive. The PCR-based method of subtractive hybridization requires less starting material, and allows the simultaneous isolation of all differentially expressed cDNAs into two  
25           groups (up-regulated and down-regulated).

          However, the PCR-based method of subtractive hybridization is also quite labor-intensive, produced large numbers of false positive candidates and ultimately resulted in the identification of a relatively limited number of  
30           differentially expressed genes. (see Kelder1-USA application).

          In order to expand the number of genes that can be analyzed simultaneously, several groups have begun to utilize DNA microarray analysis to measure differences in  
35           gene expression between normal and diseased states. However, these experiments have been limited in regards to the number of experimental conditions analyzed. DNA microarray analysis has been performed on normal, obese and

diabetic mice (21). Also, the obesity and diabetes in the mouse models examined were caused by a specific endogenous genetic mutation (22). The differentially expressed genes in the above models may be very different from genes differentially expressed due to diet-induced obesity and Type-II diabetes.

The use of differential expression and related techniques to identify genes useful in the treatment of diabetes has been reviewed by Perfetti, et al., *Diabetes Technol. & Therapeut.*, 5(3): 421-3 (2003). Bernal-Mizrachi, et al., *Diabetes Metab. Res. Rev.* 19: 32-42 (2003).

Other papers of interest include:

Wada, et al., "Gene expression profile in streptozotocin-induced diabetic mice kidneys undergoing glomerulosclerosis", *Kidney Int.*, 59:1363-73 (2001);

Song, et al., "Cloning of a novel gene in the human kidney homologous to rat munc13S: its potential role in diabetic nephropathy", *Kidney Int.*, 53:1689-95 (1998);

Page, et al., "Isolation of diabetes-associated kidney genes using differential display", *Biochem. Biophys. Res. Comm.*, 232:49-53 (1997).

Peradi, "Subtractive hybridization claims: An efficient technique to detect overexpressed mRNAs in diabetic nephropathy," *Kidney Int.* 53:926-31 (1998).

Condorelli, *EMBO J.*, 17:3858-66 (1998).

### **Differential Expression in Muscle**

Sreekumar, et al., "Gene expression profile in skeletal muscle of type 2 diabetes and the effect of insulin treatment," *Diabetes* 51: 1913 (June 2002) surveyed 6,451 genes, and identified 85 genes for which there was an alteration in skeletal muscle transcription in diabetic patients after withdrawal of insulin treatment. Subsequent insulin treatment resulted in further changes in transcription of 74 of the 85 genes (15 increased, 59

decreased), and also resulted in alteration of 29 additional gene transcripts.

5 Mootha, et al., "PCG-1 $\alpha$  responsive genes involved in  
oxidative phosphorylation are coordinatively downregulated  
in human diabetes," *Nature Genetics* 34(3); 267 (July 2003),  
used DNA microarrays to detect changes in the expression of  
sets of related genes, rather than of individual genes. They  
classified over 22,000 genes into 149 data sets; some of  
10 these data sets overlapped. They looked for a statistical  
correlation between the overall rank order of the genes in  
differential expression, and the groups to which the genes  
belonged. Expression was compared pairwise among three  
groups: males with normal glucose tolerance; males with  
15 impaired glucose tolerance; and males with type 2 diabetes.  
The set with the highest enrichment score (the one whose  
members ranked highly most often relative to chance  
expectation) was an internally curated set of 106 genes  
involved in oxidative phosphorylation. While the average  
20 decrease for the individual genes was modest (~20%), it was  
also consistent, being observed in 89% (94/106) of the genes  
in question. This paper is reviewed by Toye and Gauguier,  
"Genetics and functional genomics of type 2 diabetes  
mellitus", *Genome Biology*, 4: 241 (2003).

25 Patti, et al., "Coordinated reduction of genes of oxidative  
metabolism in humans with insulin resistance and diabetes:  
Potential role of PGC1 and NRF1", *Proc. Nat. Acad. Sci.*  
(USA), 100(14): 8466 (July 8, 2003) used microarrays to  
30 analyze skeletal muscle expression of genes in nondiabetic  
insulin-resistant subjects at high risk for diabetes (based  
on family history of diabetes and Mexican-American  
ethnicity) and diabetic Mexican-American subjects. Of 7,129  
sequences represented on the microarray, 187 were  
35 differentially expressed between control and diabetic  
subjects. However, no single gene remained significantly  
differentially expressed after controlling for multiple  
comparison false discovery by using the Benjamini-Hochberg

method, see Benjamini, et al., J. R. Stat. Soc. Ser. B. 57:289-300 (1995); Dudait, et al., Stat. Sin. 12: 111-139 (2002). Consequently, Patti et al. sought to identify groups of related genes with similar patterns of differential expression using MAPP FINDER and ONTOEXPRESS. According to MAPP FINDER, the top-ranked cellular component terms were mitochondrion, mitochondrial membrane, mitochondrial inner membrane, and ribosome, and the top-ranked process term was ATP biosynthesis. According to ONTOEXPRESS, the over-represented groups were energy generation, protein biosynthesis/ribosomal proteins, RNA binding, ribosomal structural protein, and ATP synthase complex.

Huang, Xudong, "Identification of abnormally expressed genes in skeletal muscle contributing to insulin resistance and type 2 diabetes", Thesis, document id: 9576 Lunds University 2002, reported differential expression of the mitochondrially-encoded ND1 gene in human diabetic patients and of the nuclear-encoded cathepsin L gene in mice.

Standaert, et al., "Skeletal muscle insulin resistance in obesity-associated type 2 diabetes in monkeys is linked to a defect in insulin activation of protein kinase C-zeta/lambda/iota Diabetes 51: 2936 (Oct. 2002). the authors concluded that defective activation of atypical PKCs played an important role in the pathogenesis of peripheral insulin resistance in both obese prediabetic and diabetic monkeys. They attributed this linkage to the apparent requirement for aPKCs during insulin-stimulated glucose transport.

Srommer, et al., Am. J. Physiol., "Skeletal muscle insulin resistance after trauma: insulin signaling and glucose transport", 275(2 Pt. 1): E3518(Aug. 1998) concluded that insulin resistance in skeletal muscle after surgical trauma is associated with reduced glucose transport but not with impaired glucose signaling to PI 3-kinase or its downstream target, Akt.

**SUMMARY OF THE INVENTION**

Differential hybridization techniques have been used to identify mouse genes that are differentially expressed in mice, depending upon their development of hyperinsulinemia or type II diabetes.

In essence, complementary RNA derived from normal mice, or mouse models of hyperinsulinemia or type II diabetes, was screened for hybridization with oligonucleotide probes each specific to a particular mouse gene, each gene in turn representative of a particular mouse gene cluster (Unigene). Mouse genes which were differentially expressed (normal vs. hyperinsulinemic, hyperinsulinemic vs. diabetic, or normal vs. diabetic), as measured by different levels of hybridization of the respective cRNA samples with the particular probe corresponding to that mouse gene) were identified. Related human genes and proteins were identified by sequence comparisons to the mouse gene or protein.

After identifying related human genes and proteins, one may formulate agents useful in screening humans at risk for progression toward hyperinsulinemia or toward type II diabetes.

Since the progression is from normal to hyperinsulinemic, and thence from hyperinsulinemic to type II diabetic, one may define mammalian subjects as being more favored or less favored, with normal subjects being more favored than hyperinsulinemic subjects, and hyperinsulinemic subjects being more favored than type II diabetic subjects. The subjects' state may then be correlated with their gene expression activity.

Thus, "favorable" human genes/proteins are defined as those corresponding to mouse genes which were less strongly expressed in mouse hyperinsulinemic muscle than in control muscle, or less strongly expressed in mouse type II diabetic muscle than in hyperinsulinemic muscle. (The control muscle is the muscle of a mouse which is normal vis-a-vis fasting insulin and fasting glucose levels . The term "normal", as

used herein, means normal relative to those parameters, and does not necessitate that the mouse be normal in every respect.) Likewise, one may define "unfavorable" human genes/proteins as those corresponding to mouse genes which were more strongly expressed in mouse hyperinsulinemic muscle than in control muscle, or more strongly expressed in mouse type II diabetic muscle than in hyperinsulinemic muscle.

As used herein, the term "corresponding" does not mean identical, but rather implies the existence of a statistically significant sequence similarity, such as one sufficient to qualify the human protein or gene as a homologous protein or DNA as defined below. The greater the degree of relationship as thus defined (i.e., by the statistical significance of each alignment used to connect the mouse cDNA to the human protein or gene, measured by an E value), the more close the correspondence. The connection may be direct (mouse gene to human protein) or indirect (e.g., mouse gene to human gene, human gene to human protein). By "mouse gene", we mean the mouse gene from which the gene chip DNA in question was derived.

In general, the human genes/proteins which most closely correspond, directly or indirectly, to the mouse genes are preferred, such as the one(s) with the highest, top two highest, top three highest, top four highest, top five highest, and top ten highest E values for the final alignment in the connection process. The human genes/proteins deemed to correspond to our mouse cDNA clones are identified in the Master Tables.

A human gene/protein corresponding to a mouse cDNA which was more strongly expressed in hyperinsulinemic muscle than in either normal or type II diabetic muscle (i.e.,  $C < HI, HI > D$ ) will be deemed both "unfavorable", by virtue of the control:hyperinsulinemic comparison, and "favorable", by virtue of the hyperinsulinemic:diabetic comparison. This is one of several possible "mixed" expression patterns.

Thus, we can subdivide the "favorables" into wholly and partially favorables. Likewise, we can subdivide the



unfavorables into wholly and partially unfavorable. The genes/proteins with "mixed" expression patterns are, by definition, both partially favorable and partially unfavorable. In general, use of the wholly favorable or wholly unfavorable genes/proteins is preferred to use of the partially favorable or partially unfavorable ones.

Agents which bind the "favorable" and "unfavorable" nucleic acids (e.g., the agent is a substantially complementary nucleic acid hybridization probe), or the corresponding proteins (e.g., an antibody vs. the protein) may be used to evaluate whether a human subject is at increased or decreased risk for progression toward type II diabetes. A subject with one or more elevated "unfavorable" and/or one or more depressed "favorable" genes/proteins is at increased risk, and one with one or more elevated "favorable" and/or one or more depressed "unfavorable" genes/proteins is at decreased risk. One may further take into account whether the subject is normoinsulinemic or hyperinsulinemic at the time of the assay. If the subject is non-diabetic and normoinsulinemic, we are especially interested in the "favorable" and "unfavorable" genes/proteins corresponding to mouse genes differentially expressed in hyperinsulinemic vs. normal muscle. If the subject is already hyperinsulinemic, yet non-diabetic, we are especially interested in the "favorable" and "unfavorable" genes/proteins corresponding to mouse genes differentially expressed in type II diabetic vs. hyperinsulinemic muscle.

The assay may be used as a preliminary screening assay to select subjects for further analysis, or as a formal diagnostic assay.

The identification of the related genes and proteins may also be useful in protecting humans against these disorders.

Thus, Applicants contemplate:

- (1) use of the "favorable" mouse DNAs of the Master Tables (below) to isolate or identify related human DNAs;
- (2) use of human DNAs, related to favorable mouse DNAs,  
5 to express the corresponding human proteins;
- (3) use of the corresponding human proteins (and mouse proteins, if biologically active in humans), to protect against the disorder(s);
- (4) use of the corresponding mouse or human proteins,  
10 or nucleic acid probes derived from the mouse or human genes, in diagnostic agents, in assays to measure progression toward hyperinsulinemia or type II diabetes, or protection against the disorder(s), or to estimate related end organ damage such as kidney damage; and
- 15 (5) use of the corresponding human or mouse genes therapeutically in gene therapy, to protect against the disorder(s).

Moreover Applicants contemplate:

- 20 (1) use of the "unfavorable" mouse DNAs of the Master Tables to isolate or identify related human DNAs;
- (2) use of the complement to the "unfavorable" mouse DNAs or related human DNAs, as antisense molecules to inhibit expression of the related human DNAs;
- (3) use of the mouse or human DNAs to express the  
25 corresponding mouse or human proteins;
- (4) use of the corresponding mouse or human proteins, in diagnostic agents, to measure progression toward hyperinsulinemia or type II diabetes, or protection against the disorder(s), or to estimate related end organ damage  
30 such as kidney damage;
- (5) use of the corresponding mouse or human proteins in assays to determine whether a substance binds to (and hence may neutralize) the protein; and
- (6) use of the neutralizing substance to protect  
35 against the disorder(s).

The related human DNAs may be identified by comparing the mouse sequence (or its AA translation product) to known human DNAs (and their AA translation products). If this is

unsuccessful, human cDNA or genomic DNA libraries may be screened using the mouse DNA as a probe.

5 Our animal models of hyperinsulinemia and diabetes are also obese. It is possible that the genes found to be favorable act indirectly by inhibiting obesity. Likewise, it is possible that the genes found to be unfavorable act indirectly by accentuating obesity. Consequently, it is within the compass of the present invention to use the  
10 favorable genes and proteins, or to use antagonists of the unfavorable genes and proteins, to protect against obesity, as well as against sequelae of obesity such as hyperinsulinemia and diabetes.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

### Subjects

5           A mouse is considered to be a diabetic subject if, regardless of its fasting plasma insulin level, it has a fasting plasma glucose level of at least 190 mg/dL. A mouse is considered to be a hyperinsulinemic subject if its  
10           fasting plasma insulin level is at least 0.67 ng/mL and it does not qualify as a diabetic subject. A mouse is considered to be "normal" if it is neither diabetic nor hyperinsulinemic. Thus, normality is defined in a very limited manner.

15           A mouse is considered "obese" if its weight is at least 15% in excess of the mean weight for mice of its age and sex. A mouse which does not satisfy this standard may be characterized as "non-obese", the term "normal" being reserved for use in reference to glucose and insulin levels as previously described.

20           A human is considered a diabetic subject if, regardless of his or her fasting plasma insulin level, the fasting plasma glucose level is at least 126 mg/dL. A human is considered a hyperinsulinemic subject if the fasting plasma  
25           insulin level is more than 26 micro International Units/mL (it is believed that this is equivalent to 1.08 ng/mL), and does not qualify as a diabetic subject. A human is considered to be "normal" if it is neither diabetic nor hyperinsulinemic. Thus, normality is defined in a very  
30           limited manner.

          A human is considered "obese" if the body mass index (BMI) (weight divided by height squared) is at least 30 kg/m<sup>2</sup>. A human who does not satisfy this standard may be characterized as "non-obese", the term "normal" being  
35           reserved for use in reference to glucose and insulin levels as previously described.

          A human is considered overweight if the BMI is at least 25 kg/m<sup>2</sup>. Thus, we define overweight to include obese

individuals, consistent with the recommendations of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). A human who does not satisfy this standard may be characterized as "non-overweight."

5

According to the Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, Diabetes Care 20: 1183-97 (1997), the following are risk factors for diabetes type II:

10

older (e.g., at least 45; see below)

excessive weight (see below)

15

first-degree relative with diabetes mellitus

member of high risk ethnic group (black, Hispanic, Native American, Asian)

20

history of gestational diabetes mellitus or delivering a baby weighing more than 9 pounds (4.032 kg)

hypertensive ( $>140/90$  mm Hg)

25

HDL cholesterol level  $>35$  mg/dL (0.90 mmol/L)

triglyceride level  $\geq 250$  mg/dL (2.83 mmol/L)

30

Hence, in a preferred embodiment, the diagnostic and protective methods of the present invention are applied to human subjects exhibiting one or more of the aforementioned risk factors. Likewise, in a preferred embodiment, they are applied to human subjects who, while not diabetic, exhibit impaired glucose homeostasis (110 to  $<126$  mg/dL).

35

The risk of diabetes increases with age. Hence, in successive preferred embodiments, the age of the subjects is

at least 45, at least 50, at least 55, at least 60, at least 65, at least 70, and at least 75.

With regard to excessive weight, NIDDK says that "The relative risk of diabetes increases by approximately 25 percent for each additional unit of BMI over 22." Hence, in successive preferred embodiments, the BMIs of the human subjects is at least 23, at least 24, at least 25 (i.e., overweight by our criterion), at least 26, at least 27, at least 28, at least 29, at least 30 (i.e., obese), at least 31, at least 32, at least 33, at least 34, at least 35, at least 36, at least 37, at least 38, at least 39, at least 40, or over 40.

#### **Genes/Proteins of Interest**

Favorable genes/proteins are those corresponding to genes less strongly expressed in hyperinsulinemic muscle than in normal muscle, or in type II diabetic muscle as compared to hyperinsulinemic muscle. Unfavorable genes/proteins are those corresponding to genes more strongly expressed in hyperinsulinemic muscle than in normal muscle, or in type II diabetic muscle as compared to hyperinsulinemic muscle.

Mixed genes/proteins are those exhibiting a combination of favorable and unfavorable behavior. A mixed gene/protein can be used as would a favorable gene/protein if its favorable behavior outweighs the unfavorable. It can be used as would an unfavorable gene/protein if its unfavorable behavior outweighs the favorable. Preferably, they are used in conjunction with other agents that affect their balance of favorable and unfavorable behavior. Use of mixed genes/proteins is, in general, less desirable than use of purely favorable or purely unfavorable genes/proteins.

For each of the differentially expressed genes, corresponding mouse and human proteins have been identified, as set forth in the Master Tables.

### **Direct and Indirect Utility of Identified Nucleic Acid Sequences and Related Molecules**

The mouse or human genes (or fragments thereof) may be used directly. For diagnostic or screening purposes, they (or specific binding fragments thereof) may be labeled and used as hybridization probes. For therapeutic purposes, they (or specific binding fragments thereof) may be used as antisense reagents to inhibit the expression of the corresponding gene, or of a sufficiently homologous gene of another species.

Since each of the probes is representative of a full-length mouse gene, that is, it encodes an entire, functional protein, then it may be used in the expression of that protein. Likewise, if the corresponding human gene is known in full-length, it may be used to express the human protein. Such expression may be in cell culture, with the protein subsequently isolated and administered exogenously to subjects who would benefit therefrom, or in vivo, i.e., administration by gene therapy. Naturally, any DNA encoding the same protein, or a fragment or a mutant protein which retains the desired activity, may be used for the same purpose. The encoded protein of course has utility therapeutically and, in labeled or immobilized form, diagnostically.

The genes may also be used indirectly, that is, to identify other useful DNAs, proteins, or other molecules.

There thus are several ways that a human protein homologue of interest can be identified by database searching, including:

- 1) a DNA->DNA (BlastN) search for database DNAs closely related to the mouse gene identifies a known human gene, and the sequence of the human protein is deduced by the Genetic Code;

2) a DNA->Protein (BlastX) search for database proteins closely related to the translated DNA of the mouse gene identifies a known human protein; and

5 3) the sequence of the mouse protein is known or is deduced by the Genetic Code, and a Protein->Protein (BlastP) search for closely related database proteins identifies a known human protein.

10 Once a known human gene is identified, it may be used in further BlastN or BlastX searches to identify other human genes or proteins. Once a known human protein is identified, it may be used in further BlastP searches to identify other human proteins.

15 Searches may also take cognizance, intermediately, of known genes and proteins other than mouse or human ones, e.g., use the mouse sequence to identify a known rat sequence and then the rat sequence to identify a human one.

20 Thus, if we have identified a mouse gene, and it encodes a mouse protein which appears similar to a human protein, then that human protein may be used (especially in humans) for purposes analogous to the proposed use of the mouse protein in mice. Moreover, a specific binding  
25 fragment of an appropriate strand of the corresponding human gene or cDNA could be labeled and used as a hybridization probe (especially against samples of human mRNA or cDNA).

In determining whether the disclosed genes have  
30 significant similarities to known DNAs (and their translated AA sequences to known proteins), one would generally use the disclosed gene as a query sequence in a search of a sequence database. The results of several such searches are set forth in the Examples. Such results are dependent, to some  
35 degree, on the search parameters. Preferred parameters are set forth in Example 1. The results are also dependent on the content of the database. While the raw similarity score of a particular target (database) sequence will not vary



with content (as long as it remains in the database), its informational value (in bits), expected value, and relative ranking can change. Generally speaking, the changes are small.

5

It will be appreciated that the nucleic acid and protein databases keep growing. Hence a later search may identify high scoring target sequences which were not uncovered by an earlier search because the target sequences were not previously part of a database.

Hence, in a preferred embodiment, the cognate DNAs and proteins include not only those set forth in the examples, but those which would have been highly ranked (top ten, more preferably top three, even more preferably top two, most preferably the top one) in a search run with the same parameters on the date of filing of this application.

If the known human DNA is appears to be a partial DNA, it may be used as a hybridization probe to isolate the full-length DNA. If the partial DNA encodes a biologically functional fragment of the cognate protein, it may be used in a manner similar to the full length DNA, i.e., to produce the functional fragment.

25

If we have indicated that an antagonist of a protein or other molecule is useful, then such an antagonist may be obtained by preparing a combinatorial library, as described below, of potential antagonists, and screening the library members for binding to the protein or other molecule in question. The binding members may then be further screened for the ability to antagonize the biological activity of the target. The antagonists may be used therapeutically, or, in suitably labeled or immobilized form, diagnostically.

35

If the identified DNA is related to a known protein, then substances known to interact with that protein (e.g., agonists, antagonists, substrates, receptors, second messengers, regulators, and so forth), and binding molecules

which bind them, are also of utility. Such binding molecules can likewise be identified by screening a combinatorial library.

#### 5     **Isolation of Full Length cDNAs Using Partial cDNAs as probes**

      If it is determined that a DNA of the present invention is a partial DNA, and the cognate full length DNA is not listed in a sequence database, the available DNA may be used as a hybridization probe to isolate the full-length cDNA  
10    from a suitable cDNA library.

      Stringent hybridization conditions are appropriate, that is, conditions in which the hybridization temperature is 5-10 deg. C. below the  $T_m$  of the cDNA as a perfect duplex.

15

#### **Identification and Isolation of Homologous Genes/cDNAs Using a cDNA Probe**

      It may be that the sequence databases available do not include the sequence of any homologous gene, or at least of  
20    the homologous gene for a species of interest. However, given the cDNAs set forth above, one may readily obtain the homologous gene.

      The possession of one DNA (the "starting DNA") greatly facilitates the isolation of homologous genes/cDNAs. If  
25    only a partial DNA is known, this partial DNA may first be used as a probe to isolate the corresponding full length DNA for the same species, and that the latter may be used as the starting DNA in the search for homologous genes.

      The starting DNA, or a fragment thereof, is used as a  
30    hybridization probe to screen a cDNA or genomic DNA library for clones containing inserts which encode either the entire homologous protein, or a recognizable fragment thereof. The minimum length of the hybridization probe is dictated by the need for specificity. If the size of the library in bases  
35    is  $L$ , and the GC content is 50%, then the probe should have a length of at least  $l$ , where  $L = 4^l$ . This will yield, on average, a single perfect match in random DNA of  $L$  bases.

The human cDNA library is about  $10^8$  bases and the human genomic DNA library is about  $10^{10}$  bases.

The library is preferably derived from an organism which is known, on biochemical evidence, to produce a homologous protein, and more preferably from the genomic DNA or mRNA of cells of that organism which are likely to be relatively high producers of that protein. A cDNA library (which is derived from an mRNA library) is especially preferred.

If the organism in question is known to have substantially different codon preferences from that of the organism whose relevant cDNA or genomic DNA is known, a synthetic hybridization probe may be used which encodes the same amino acid sequence but whose codon utilization is more similar to that of the DNA of the target organism. Alternatively, the synthetic probe may employ inosine as a substitute for those bases which are most likely to be divergent, or the probe may be a mixed probe which mixes the codons for the source DNA with the preferred codons (encoding the same amino acid) for the target organism.

By routine methods, the  $T_m$  of a perfect duplex of starting DNA is determined. One may then select a hybridization temperature which is sufficiently lower than the perfect duplex  $T_m$  to allow hybridization of the starting DNA (or other probe) to a target DNA which is divergent from the starting DNA. A 1% sequence divergence typically lowers the  $T_m$  of a duplex by 1-2°C, and the DNAs encoding homologous proteins of different species typically have sequence identities of around 50-80%. Preferably, the library is screened under conditions where the temperature is at least 20°C., more preferably at least 50°C., below the perfect duplex  $T_m$ . Since salt reduces the  $T_m$ , one ordinarily would carry out the search for DNAs encoding highly homologous proteins under relatively low salt hybridization conditions, e.g., <1M NaCl. The higher the salt concentration, and/or the lower the temperature, the greater the sequence divergence which is tolerated.

For the use of probes to identify homologous genes in other species, see, e.g., Schwinn, et al., J. Biol. Chem., 265:8183-89 (1990) (hamster 67-bp cDNA probe vs. human leukocyte genomic library; human 0.32kb DNA probe vs. bovine brain cDNA library, both with hybridization at 42°C in 6xSSC); Jenkins et al., J. Biol. Chem., 265:19624-31 (1990) (Chicken 770-bp cDNA probe vs. human genomic libraries; hybridization at 40°C in 50% formamide and 5xSSC); Murata et al., J. Exp. Med., 175:341-51 (1992) (1.2-kb mouse cDNA probe v. human eosinophl cDNA library; hybridization at 65°C in 6xSSC); Guyer et al., J. Biol. Chem., 265:17307-17 (1990) (2.95-kb human genomic DNA probe vs. porcine genomic DNA library; hybridization at 42°C in 5xSSC). The conditions set forth in these articles may each be considered suitable for the purpose of isolating homologous genes.

#### **Homologous Proteins and DNAs**

A human protein can be said to be identifiable as homologous to a mouse gene (and hence to "correspond" to such gene) if

(1) its sequence can be aligned to the mouse gene, using BlastX with the default parameters set forth below, and the expected value (E) of the alignment (the probability that such an alignment would have occurred by chance alone) is less than  $e^{-10}$ ,

(2) its sequence can be aligned to a human gene, using BlastX with the default parameters set forth below, and the cDNA of said human gene can be aligned to the mouse gene, using BlastN with the default parameters set forth below, and the E value for both alignments is less than  $e^{-10}$ ,

(3) its sequence can be aligned to a mouse protein, using BlastP with the default parameters set forth below, and that mouse protein can be aligned to the mouse gene, using BlastX

with the default parameters set forth below, and in both alignments the E value of the alignment is less than e-10.

Naturally, if the human protein is encoded by the human gene of (2), or the mouse protein is encoded by the mouse gene of (3), the BlastX alignment will be satisfied.

Desirably, two or all three of these conditions (1)-(3) are satisfied.

Preferably, for any of the alignments noted above, and more preferably for all of them, the E value is less than e-15, more preferably less than e-20, still more preferably less than e-40, even more preferably less than e-60, considerably more preferably less than e-80, and most preferably less than e-100. More preferably, for those conditions in which the mouse cDNA clone is indirectly connected to the human protein by virtue of two or more successive alignments, the E value is so limited for all of said alignments in the connecting chain.

BlastN and BlastX report very low expected values as "0.0". This does not truly mean that the expected value is exactly zero (since any alignment could occur by chance), but merely that it is so infinitesimal that it is not reported. The documentation does not state the cutoff value, alignments with explicit E values as low as e-178 (624 bits) have been reported as such, while a score of 636 bits was reported as "0.0".

Functionally homologous human proteins are also of interest. A human protein may be said to be functionally homologous to the mouse gene if (1) it can be aligned to the mouse gene, using BlastX with the default parameters set forth below, and the E value of the alignment is less than e-50, and (2) the human protein has at least one biological activity in common with the mouse protein.

The human proteins of interest also include those that are substantially and/or conservatively identical (as defined below) to the homologous and/or functionally homologous human proteins defined above.

5

### **Relevance of Favorable and Unfavorable Genes**

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If a gene is down-regulated in more favored mammals, or up-regulated in less favored mammals, (i.e., an "unfavorable gene") then several utilities are apparent.

First, the complementary strand of the gene, or a portion thereof, may be used in labeled form as a hybridization probe to detect messenger RNA and thereby monitor the level of expression of the gene in a subject. Elevated levels are indicative of progression, or propensity to progression, to a less favored state, and clinicians may take appropriate preventative, curative or ameliorative action.

Secondly, the messenger RNA product (or equivalent cDNA), the protein product, or a binding molecule specific for that product (e.g., an antibody which binds the product), or a downstream product which mediates the activity (e.g., a signaling intermediate) or a binding molecule (e.g., an antibody) therefor, may be used, preferably in labeled or immobilized form, as an assay reagent in an assay for said nucleic acid product, protein product, or downstream product (e.g., a signaling intermediate). Again, elevated levels are indicative of a present or future problem.

Thirdly, an agent which down-regulates expression of the gene may be used to reduce levels of the corresponding protein and thereby inhibit further damage. This agent could inhibit transcription of the gene in the subject, or translation of the corresponding messenger RNA. Possible inhibitors of transcription and translation include

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antisense molecules and repressor molecules. The agent could also inhibit a post-translational modification (e.g., glycosylation, phosphorylation, cleavage, GPI attachment) required for activity, or post-translationally modify the protein so as to inactivate it. Or it could be an agent which down- or up-regulated a positive or negative regulatory gene, respectively.

Fourthly, an agent which is an antagonist of the messenger RNA product or protein product of the gene, or of a downstream product through which its activity is manifested (e.g., a signaling intermediate), may be used to inhibit its activity.

This antagonist could be an antibody, a peptide, a peptoid, a nucleic acid, a peptide nucleic acid (PNA) oligomer, a small organic molecule of a kind for which a combinatorial library exists (e.g., a benzodiazepine), etc. An antagonist is simply a binding molecule which, by binding, reduces or abolishes the undesired activity of its target. The antagonist, if not an oligomeric molecule, is preferably less than 500 daltons.

Fifthly, an agent which degrades, or abets the degradation of, that messenger RNA, its protein product or a downstream product which mediates its activity (e.g., a signaling intermediate), may be used to curb the effective period of activity of the protein.

If a gene is up-regulated in more favored mammals, or down-regulated in less favored animals then the utilities are converse to those stated above.

First, the complementary strand of the gene, or a portion thereof, may be used in labeled form as a hybridization probe to detect messenger RNA and thereby monitor the level of expression of the gene in a subject. Depressed levels are indicative of damage, or possibly of a propensity to damage, and clinicians may take appropriate preventative, curative or ameliorative action.

Secondly, the messenger RNA product, the equivalent cDNA, protein product, or a binding molecule specific for those products, or a downstream product, or a signaling

intermediate, or a binding molecule therefor, may be used, preferably in labeled or immobilized form, as an assay reagent in an assay for said protein product or downstream product. Again, depressed levels are indicative of a present or future problem.

Thirdly, an agent which up-regulates expression of the gene may be used to increase levels of the corresponding protein and thereby inhibit further progression to a less favored state. By way of example, it could be a vector which carries a copy of the gene, but which expresses the gene at higher levels than does the endogenous expression system. Or it could be an agent which up- or down-regulates a positive or negative regulatory gene.

Fourthly, an agent which is an agonist of the protein product of the gene, or of a downstream product through which its activity (of inhibition of progression to a less favored state) is manifested, or of a signaling intermediate may be used to foster its activity.

Fifthly, an agent which inhibits the degradation of that protein product or of a downstream product or of a signaling intermediate may be used to increase the effective period of activity of the protein.

## **Mutant Proteins**

The present invention also contemplates mutant proteins (peptides) which are substantially identical (as defined below) to the parental protein (peptide). In general, the fewer the mutations, the more likely the mutant protein is to retain the activity of the parental protein. The effect of mutations is usually (but not always) additive. Certain individual mutations are more likely to be tolerated than others.

A protein is more likely to tolerate a mutation which

(a) is a substitution rather than an insertion or deletion;

(b) is an insertion or deletion at the terminus, rather than internally, or, if internal, is at a



domain boundary, or a loop or turn, rather than in an alpha helix or beta strand;

(c) affects a surface residue rather than an interior residue;

5 (d) affects a part of the molecule distal to the binding site;

(e) is a substitution of one amino acid for another of similar size, charge, and/or hydrophobicity, and does not destroy a disulfide bond or other crosslink; and

10 (f) is at a site which is subject to substantial variation among a family of homologous proteins to which the protein of interest belongs.

These considerations can be used to design functional mutants.

15

#### *Surface vs. Interior Residues*

Charged residues almost always lie on the surface of the protein. For uncharged residues, there is less certainty, but in general, hydrophilic residues are partitioned to the surface and hydrophobic residues to the interior. Of course, for a membrane protein, the membrane-spanning segments are likely to be rich in hydrophobic residues.

20

25 Surface residues may be identified experimentally by various labeling techniques, or by 3-D structure mapping techniques like X-ray diffraction and NMR. A 3-D model of a homologous protein can be helpful.

#### 30 *Binding Site Residues*

Residues forming the binding site may be identified by (1) comparing the effects of labeling the surface residues before and after complexing the protein to its target, (2) labeling the binding site directly with affinity ligands, (3) fragmenting the protein and testing the fragments for binding activity, and (4) systematic mutagenesis (e.g., alanine-scanning mutagenesis) to determine which mutants destroy binding. If the binding site of a homologous

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protein is known, the binding site may be postulated by analogy.

Protein libraries may be constructed and screened that a large family (e.g.,  $10^8$ ) of related mutants may be evaluated simultaneously.

Hence, the mutations are preferably conservative modifications as defined below.

#### "Substantially Identical"

A mutant protein (peptide) is substantially identical to a reference protein (peptide) if (a) it has at least 10% of a specific binding activity or a non-nutritional biological activity of the reference protein, and (b) is at least 50% identical in amino acid sequence to the reference protein (peptide). It is "substantially structurally identical" if condition (b) applies, regardless of (a).

Percentage amino acid identity is determined by aligning the mutant and reference sequences according to a rigorous dynamic programming algorithm which globally aligns their sequences to maximize their similarity, the similarity being scored as the sum of scores for each aligned pair according to an unbiased PAM250 matrix, and a penalty for each internal gap of -12 for the first null of the gap and -4 for each additional null of the same gap. The percentage identity is the number of matches expressed as a percentage of the adjusted (i.e., counting inserted nulls) length of the reference sequence.

A mutant DNA sequence is substantially identical to a reference DNA sequence if they are structural sequences, and encoding mutant and reference proteins which are substantially identical as described above.

If instead they are regulatory sequences, they are substantially identical if the mutant sequence has at least 10% of the regulatory activity of the reference sequence, and is at least 50% identical in nucleotide sequence to the reference sequence. Percentage identity is determined as for proteins except that matches are scored +5, mismatches -

4, the gap open penalty is -12, and the gap extension penalty (per additional null) is -4.

Preferably, sequence which are substantially identical exceed the minimum identity of 50% e.g., are 51%, 66%, 75%, 80%, 85%, 90%, 95% or 99% identical in sequence.

DNA sequences may also be considered "substantially identical" if they hybridize to each other under stringent conditions, i.e., conditions at which the  $T_m$  of the heteroduplex of the one strand of the mutant DNA and the more complementary strand of the reference DNA is not in excess of 10°C. less than the  $T_m$  of the reference DNA homoduplex. Typically this will correspond to a percentage identity of 85-90%.

#### "Conservative Modifications"

"Conservative modifications" are defined as

(a) conservative substitutions of amino acids as hereafter defined; or

(b) single or multiple insertions (extension) or deletions (truncation) of amino acids at the termini.

Conservative modifications are preferred to other modifications. Conservative substitutions are preferred to other conservative modifications.

"Semi-Conservative Modifications" are modifications which are not conservative, but which are (a) semi-conservative substitutions as hereafter defined; or (b) single or multiple insertions or deletions internally, but at interdomain boundaries, in loops or in other segments of relatively high mobility. Semi-conservative modifications are preferred to nonconservative modifications. Semi-conservative substitutions are preferred to other semi-conservative modifications.

Non-conservative substitutions are preferred to other non-conservative modifications.

The term "conservative" is used here in an a priori sense, i.e., modifications which would be expected to preserve 3D structure and activity, based on analysis of the

naturally occurring families of homologous proteins and of past experience with the effects of deliberate mutagenesis, rather than post facto, a modification already known to conserve activity. Of course, a modification which is conservative a priori may, and usually is, also conservative post facto.

Preferably, except at the termini, no more than about five amino acids are inserted or deleted at a particular locus, and the modifications are outside regions known to contain binding sites important to activity.

Preferably, insertions or deletions are limited to the termini.

A conservative substitution is a substitution of one amino acid for another of the same exchange group, the exchange groups being defined as follows

- I Gly, Pro, Ser, Ala (Cys) (and any nonbiogenic, neutral amino acid with a hydrophobicity not exceeding that of the aforementioned a.a.'s)
- II Arg, Lys, His (and any nonbiogenic, positively-charged amino acids)
- III Asp, Glu, Asn, Gln (and any nonbiogenic negatively-charged amino acids)
- IV Leu, Ile, Met, Val (Cys) (and any nonbiogenic, aliphatic, neutral amino acid with a hydrophobicity too high for I above)
- V Phe, Trp, Tyr (and any nonbiogenic, aromatic neutral amino acid with a hydrophobicity too high for I above).

Note that Cys belongs to both I and IV.

Residues Pro, Gly and Cys have special conformational roles. Cys participates in formation of disulfide bonds. Gly imparts flexibility to the chain. Pro imparts rigidity to the chain and disrupts  $\alpha$  helices. These residues may be essential in certain regions of the polypeptide, but substitutable elsewhere.

One, two or three conservative substitutions are more likely to be tolerated than a larger number.

"Semi-conservative substitutions" are defined herein as being substitutions within supergroup I/II/III or within supergroup IV/V, but not within a single one of groups I-V. They also include replacement of any other amino acid with alanine. If a substitution is not conservative, it preferably is semi-conservative.

"Non-conservative substitutions" are substitutions which are not "conservative" or "semi-conservative".

"Highly conservative substitutions" are a subset of conservative substitutions, and are exchanges of amino acids within the groups Phe/Tyr/Trp, Met/Leu/Ile/Val, His/Arg/Lys, Asp/Glu and Ser/Thr/Ala. They are more likely to be tolerated than other conservative substitutions. Again, the smaller the number of substitutions, the more likely they are to be tolerated.

#### "Conservatively Identical"

A protein (peptide) is conservatively identical to a reference protein (peptide) if it differs from the latter, if at all, solely by conservative modifications, the protein (peptide) remaining at least seven amino acids long if the reference protein (peptide) was at least seven amino acids long.

A protein is at least semi-conservatively identical to a reference protein (peptide) if it differs from the latter, if at all, solely by semi-conservative or conservative modifications.

A protein (peptide) is nearly conservatively identical to a reference protein (peptide) if it differs from the latter, if at all, solely by one or more conservative modifications and/or a single nonconservative substitution.

It is highly conservatively identical if it differs, if at all, solely by highly conservative substitutions. Highly conservatively identical proteins are preferred to those merely conservatively identical. An absolutely identical protein is even more preferred.

The core sequence of a reference protein (peptide) is the largest single fragment which retains at least 10% of a particular specific binding activity, if one is specified, or otherwise of at least one specific binding activity of the referent. If the referent has more than one specific binding activity, it may have more than one core sequence, and these may overlap or not.

If it is taught that a peptide of the present invention may have a particular similarity relationship (e.g., markedly identical) to a reference protein (peptide), preferred peptides are those which comprise a sequence having that relationship to a core sequence of the reference protein (peptide), but with internal insertions or deletions in either sequence excluded. Even more preferred peptides are those whose entire sequence has that relationship, with the same exclusion, to a core sequence of that reference protein (peptide).

## Library

The term "library" generally refers to a collection of chemical or biological entities which are related in origin, structure, and/or function, and which can be screened simultaneously for a property of interest.

Libraries may be classified by how they are constructed (natural vs. artificial diversity; combinatorial vs. noncombinatorial), how they are screened (hybridization, expression, display), or by the nature of the screened library members (peptides, nucleic acids, etc.).

In a "natural diversity" library, essentially all of the diversity arose without human intervention. This would be true, for example, of messenger RNA extracted from a non-engineered cell.

In a "synthetic diversity" library, essentially all of the diversity arose deliberately as a result of human intervention. This would be true for example of a combinatorial library; note that a small level of natural diversity could still arise as a result of spontaneous

mutation. It would also be true of a noncombinatorial library of compounds collected from diverse sources, even if they were all natural products.

In a "non-natural diversity" library, at least some of the diversity arose deliberately through human intervention.

In a "controlled origin" library, the source of the diversity is limited in some way. A limitation might be to cells of a particular individual, to a particular species, or to a particular genus, or, more complexly, to individuals of a particular species who are of a particular age, sex, physical condition, geographical location, occupation and/or familial relationship. Alternatively or additionally, it might be to cells of a particular tissue or organ. Or it could be cells exposed to particular pharmacological, environmental, or pathogenic conditions. Or the library could be of chemicals, or a particular class of chemicals, produced by such cells.

In a "controlled structure" library, the library members are deliberately limited by the production conditions to particular chemical structures. For example, if they are oligomers, they may be limited in length and monomer composition, e.g. hexapeptides composed of the twenty genetically encoded amino acids.

#### Hybridization Library

In a hybridization library, the library members are nucleic acids, and are screened using a nucleic acid hybridization probe. Bound nucleic acids may then be amplified, cloned, and/or sequenced.

#### Expression Library

In an expression library, the screened library members are gene expression products, but one may also speak of an underlying library of genes encoding those products. The library is made by subcloning DNA encoding the library members (or portions thereof) into expression vectors (or into cloning vectors which subsequently are used to construct expression vectors), each vector comprising an

expressible gene encoding a particular library member, introducing the expression vectors into suitable cells, and expressing the genes so the expression products are produced.

5           In one embodiment, the expression products are secreted, so the library can be screened using an affinity reagent, such as an antibody or receptor. The bound expression products may be sequenced directly, or their sequences inferred by, e.g., sequencing at least the  
10           variable portion of the encoding DNA.

          In a second embodiment, the cells are lysed, thereby exposing the expression products, and the latter are screened with the affinity reagent.

          In a third embodiment, the cells express the library  
15           members in such a manner that they are displayed on the surface of the cells, or on the surface of viral particles produced by the cells. (See display libraries, below).

          In a fourth embodiment, the screening is not for the ability of the expression product to bind to an affinity  
20           reagent, but rather for its ability to alter the phenotype of the host cell in a particular detectable manner. Here, the screened library members are transformed cells, but there is a first underlying library of expression products which mediate the behavior of the cells, and a second  
25           underlying library of genes which encode those products.

#### Display Library

          In a display library, the library members are each conjugated to, and displayed upon, a support of some kind.  
30           The support may be living (a cell or virus), or nonliving (e.g., a bead or plate).

          If the support is a cell or virus, display will normally be effectuated by expressing a fusion protein which comprises the library member, a carrier moiety allowing  
35           integration of the fusion protein into the surface of the cell or virus, and optionally a lining moiety. In a variation on this theme, the cell coexpresses a first fusion comprising the library member and a linking moiety L1, and a



second fusion comprising a linking moiety L2 and the carrier moiety. L1 and L2 interact to associate the first fusion with the second fusion and hence, indirectly, the library member with the surface of the cell or virus.

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#### Soluble Library

In a soluble library, the library members are free in solution. A soluble library may be produced directly, or one may first make a display library and then release the library members from their supports.

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#### Encapsulated Library

In an encapsulated library, the library members are inside cells or liposomes. Generally speaking, encapsulated libraries are used to store the library members for future use; the members are extracted in some way for screening purposes. However, if they differentially affect the phenotype of the cells, they may be screened indirectly by screening the cells.

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#### cDNA Library

A cDNA library is usually prepared by extracting RNA from cells of particular origin, fractionating the RNA to isolate the messenger RNA (mRNA has a poly(A) tail, so this is usually done by oligo-dT affinity chromatography), synthesizing complementary DNA (cDNA) using reverse transcriptase, DNA polymerase, and other enzymes, subcloning the cDNA into vectors, and introducing the vectors into cells. Often, only mRNAs or cDNAs of particular sizes will be used, to make it more likely that the cDNA encodes a functional polypeptide.

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A cDNA library explores the natural diversity of the transcribed DNAs of cells from a particular source. It is not a combinatorial library.

35

A cDNA library may be used to make a hybridization library, or it may be used as an (or to make) expression library.

### Genomic DNA Library

A genomic DNA library is made by extracting DNA from a particular source, fragmenting the DNA, isolating fragments of a particular size range, subcloning the DNA fragments into vectors, and introducing the vectors into cells.

Like a cDNA library, a genomic DNA library is a natural diversity library, and not a combinatorial library. A genomic DNA library may be used the same way as a cDNA library.

### Synthetic DNA library

A synthetic DNA library may be screened directly (as a hybridization library), or used in the creation of an expression or display library of peptides/proteins.

### Combinatorial Libraries

The term "combinatorial library" refers to a library in which the individual members are either systematic or random combinations of a limited set of basic elements, the properties of each member being dependent on the choice and location of the elements incorporated into it. Typically, the members of the library are at least capable of being screened simultaneously. Randomization may be complete or partial; some positions may be randomized and others predetermined, and at random positions, the choices may be limited in a predetermined manner. The members of a combinatorial library may be oligomers or polymers of some kind, in which the variation occurs through the choice of monomeric building block at one or more positions of the oligomer or polymer, and possibly in terms of the connecting linkage, or the length of the oligomer or polymer, too. Or the members may be nonoligomeric molecules with a standard core structure, like the 1,4-benzodiazepine structure, with the variation being introduced by the choice of substituents at particular variable sites on the core structure. Or the members may be nonoligomeric molecules assembled like a jigsaw puzzle, but wherein each piece has both one or more variable moieties (contributing to library diversity) and

one or more constant moieties (providing the functionalities for coupling the piece in question to other pieces).

Thus, in a typical combinatorial library, chemical building blocks are at least partially randomly combined into a large number (as high as  $10^{15}$ ) of different compounds, which are then simultaneously screened for binding (or other) activity against one or more targets.

In a "simple combinatorial library", all of the members belong to the same class of compounds (e.g., peptides) and can be synthesized simultaneously. A "composite combinatorial library" is a mixture of two or more simple libraries, e.g., DNAs and peptides, or peptides, peptoids, and PNAs, or benzodiazepines and carbamates. The number of component simple libraries in a composite library will, of course, normally be smaller than the average number of members in each simple library, as otherwise the advantage of a library over individual synthesis is small.

Libraries of thousands, even millions, of random oligopeptides have been prepared by chemical synthesis (Houghten *et al.*, *Nature*, 354:84-6(1991)), or gene expression (Marks *et al.*, *J Mol Biol*, 222:581-97(1991)), displayed on chromatographic supports (Lam *et al.*, *Nature*, 354:82-4(1991)), inside bacterial cells (Colas *et al.*, *Nature*, 380:548-550(1996)), on bacterial pili (Lu, *Bio/Technology*, 13:366-372(1990)), or phage (Smith, *Science*, 228:1315-7(1985)), and screened for binding to a variety of targets including antibodies (Valadon *et al.*, *J Mol Biol*, 261:11-22(1996)), cellular proteins (Schmitz *et al.*, *J Mol Biol*, 260:664-677(1996)), viral proteins (Hong and Boulanger, *Embo J*, 14:4714-4727(1995)), bacterial proteins (Jacobsson and Frykberg, *Biotechniques*, 18:878-885(1995)), nucleic acids (Cheng *et al.*, *Gene*, 171:1-8(1996)), and plastic (Siani *et al.*, *J Chem Inf Comput Sci*, 34:588-593(1994)).

Libraries of proteins (Ladner, *USP* 4,664,989), peptoids (Simon *et al.*, *Proc Natl Acad Sci U S A*, 89:9367-71(1992)), nucleic acids (Ellington and Szostak, *Nature*, 246:818(1990)), carbohydrates, and small organic molecules

(Eichler et al., Med Res Rev, 15:481-96(1995)) have also been prepared or suggested for drug screening purposes.

The first combinatorial libraries were composed of peptides or proteins, in which all or selected amino acid positions were randomized. Peptides and proteins can exhibit high and specific binding activity, and can act as catalysts. In consequence, they are of great importance in biological systems.

Nucleic acids have also been used in combinatorial libraries. Their great advantage is the ease with which a nucleic acid with appropriate binding activity can be amplified. As a result, combinatorial libraries composed of nucleic acids can be of low redundancy and hence, of high diversity.

There has also been much interest in combinatorial libraries based on small molecules, which are more suited to pharmaceutical use, especially those which, like benzodiazepines, belong to a chemical class which has already yielded useful pharmacological agents. The techniques of combinatorial chemistry have been recognized as the most efficient means for finding small molecules that act on these targets. At present, small molecule combinatorial chemistry involves the synthesis of either pooled or discrete molecules that present varying arrays of functionality on a common scaffold. These compounds are grouped in libraries that are then screened against the target of interest either for binding or for inhibition of biological activity.

The size of a library is the number of molecules in it. The simple diversity of a library is the number of unique structures in it. There is no formal minimum or maximum diversity. If the library has a very low diversity, the library has little advantage over just synthesizing and screening the members individually. If the library is of very high diversity, it may be inconvenient to handle, at least without automatizing the process. The simple diversity of a library is preferably at least  $10$ ,  $10E2$ ,  $10E3$ ,  $10E4$ ,  $10E6$ ,  $10E7$ ,  $10E8$  or  $10E9$ , the higher the better

under most circumstances. The simple diversity is usually not more than  $10E15$ , and more usually not more than  $10E10$ .

The average sampling level is the size divided by the simple diversity. The expected average sampling level must be high enough to provide a reasonable assurance that, if a given structure were expected, as a consequence of the library design, to be present, that the actual average sampling level will be high enough so that the structure, if satisfying the screening criteria, will yield a positive result when the library is screened. Thus, the preferred average sampling level is a function of the detection limit, which in turn is a function of the strength of the signal to be screened.

There are more complex measures of diversity than simple diversity. These attempt to take into account the degree of structural difference between the various unique sequences. These more complex measures are usually used in the context of small organic compound libraries, see below.

The library members may be presented as solutes in solution, or immobilized on some form of support. In the latter case, the support may be living (cell, virus) or nonliving (bead, plate, etc.). The supports may be separable (cells, virus particles, beads) so that binding and nonbinding members can be separated, or nonseparable (plate). In the latter case, the members will normally be placed on addressable positions on the support. The advantage of a soluble library is that there is no carrier moiety that could interfere with the binding of the members to the support. The advantage of an immobilized library is that it is easier to identify the structure of the members which were positive.

When screening a soluble library, or one with a separable support, the target is usually immobilized. When screening a library on a nonseparable support, the target will usually be labeled.

#### Oligonucleotide Libraries

An oligonucleotide library is a combinatorial library, at least some of whose members are single-stranded oligonucleotides having three or more nucleotides connected by phosphodiester or analogous bonds. The oligonucleotides may be linear, cyclic or branched, and may include non-nucleic acid moieties. The nucleotides are not limited to the nucleotides normally found in DNA or RNA. For examples of nucleotides modified to increase nuclease resistance and chemical stability of aptamers, see Chart 1 in Osborne and Ellington, *Chem. Rev.*, 97: 349-70 (1997). For screening of RNA, see Ellington and Szostak, *Nature*, 346: 818-22 (1990).

There is no formal minimum or maximum size for these oligonucleotides. However, the number of conformations which an oligonucleotide can assume increases exponentially with its length in bases. Hence, a longer oligonucleotide is more likely to be able to fold to adapt itself to a protein surface. On the other hand, while very long molecules can be synthesized and screened, unless they provide a much superior affinity to that of shorter molecules, they are not likely to be found in the selected population, for the reasons explained by Osborne and Ellington (1997). Hence, the libraries of the present invention are preferably composed of oligonucleotides having a length of 3 to 100 bases, more preferably 15 to 35 bases. The oligonucleotides in a given library may be of the same or of different lengths.

Oligonucleotide libraries have the advantage that libraries of very high diversity (e.g.,  $10^{15}$ ) are feasible, and binding molecules are readily amplified in vitro by polymerase chain reaction (PCR). Moreover, nucleic acid molecules can have very high specificity and affinity to targets.

In a preferred embodiment, this invention prepares and screens oligonucleotide libraries by the SELEX method, as described in King and Famulok, *Molec. Biol. Repts.*, 20: 97-107 (1994); L. Gold, C. Tuerk. *Methods of producing nucleic acid ligands*, US#5595877; Oliphant et al. *Gene* 44:177 (1986).

The term "aptamer" is conferred on those oligonucleotides which bind the target protein. Such aptamers may be used to characterize the target protein, both directly (through identification of the aptamer and the points of contact between the aptamer and the protein) and indirectly (by use of the aptamer as a ligand to modify the chemical reactivity of the protein).

In a classic oligonucleotide, each nucleotide (monomeric unit) is composed of a phosphate group, a sugar moiety, and either a purine or a pyrimidine base. In DNA, the sugar is deoxyribose and in RNA it is ribose. The nucleotides are linked by 5'-3' phosphodiester bonds.

The deoxyribose phosphate backbone of DNA can be modified to increase resistance to nuclease and to increase penetration of cell membranes. Derivatives such as mono- or dithiophosphates, methyl phosphonates, boranophosphates, formacetals, carbamates, siloxanes, and dimethylenethio-sulfoxideo- and-sulfono- linked species are known in the art.

### Peptide Library

A peptide is composed of a plurality of amino acid residues joined together by peptidyl (-NHCO-) bonds. A biogenic peptide is a peptide in which the residues are all genetically encoded amino acid residues; it is not necessary that the biogenic peptide actually be produced by gene expression.

Amino acids are the basic building blocks with which peptides and proteins are constructed. Amino acids possess both an amino group (-NH<sub>2</sub>) and a carboxylic acid group (-COOH). Many amino acids, but not all, have the alpha amino acid structure NH<sub>2</sub>-CHR-COOH, where R is hydrogen, or any of a variety of functional groups.

Twenty amino acids are genetically encoded: Alanine, Arginine, Asparagine, Aspartic Acid, Cysteine, Glutamic Acid, Glutamine, Glycine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Proline, Serine, Threonine, Tryptophan, Tyrosine, and Valine. Of these, all

save Glycine are optically isomeric, however, only the L-form is found in humans. Nevertheless, the D-forms of these amino acids do have biological significance; D-Phe, for example, is a known analgesic.

5 Many other amino acids are also known, including: 2-Aminoadipic acid; 3-Aminoadipic acid; beta-Aminopropionic acid; 2-Aminobutyric acid; 4-Aminobutyric acid (Piperidinic acid); 6-Aminocaproic acid; 2-Aminoheptanoic acid; 2-Aminoisobutyric acid, 3-Aminoisobutyric acid; 2-Aminopimelic  
10 acid; 2,4-Diaminobutyric acid; Desmosine; 2,2'-Diaminopimelic acid; 2,3-Diaminopropionic acid; N-Ethylglycine; N-Ethylasparagine; Hydroxylysine; allo-Hydroxylysine; 3-Hydroxyproline; 4-Hydroxyproline; Isodesmosine; allo-Isoleucine; N-Methylglycine (Sarcosine);  
15 N-Methylisoleucine; N-Methylvaline; Norvaline; Norleucine; and Ornithine.

Peptides are constructed by condensation of amino acids and/or smaller peptides. The amino group of one amino acid (or peptide) reacts with the carboxylic acid group of a  
20 second amino acid (or peptide) to form a peptide (-NHCO-) bond, releasing one molecule of water. Therefore, when an amino acid is incorporated into a peptide, it should, technically speaking, be referred to as an amino acid residue. The core of that residue is the moiety which  
25 excludes the -NH and -CO linking functionalities which connect it to other residues. This moiety consists of one or more main chain atoms (see below) and the attached side chains.

The main chain moiety of each amino acid consists of  
30 the -NH and -CO linking functionalities and a core main chain moiety. Usually the latter is a single carbon atom. However, the core main chain moiety may include additional carbon atoms, and may also include nitrogen, oxygen or sulfur atoms, which together form a single chain. In a  
35 preferred embodiment, the core main chain atoms consist solely of carbon atoms.

The side chains are attached to the core main chain atoms. For alpha amino acids, in which the side chain is



attached to the alpha carbon, the C-1, C-2 and N-2 of each residue form the repeating unit of the main chain, and the word "side chain" refers to the C-3 and higher numbered carbon atoms and their substituents. It also includes H atoms attached to the main chain atoms.

Amino acids may be classified according to the number of carbon atoms which appear in the main chain between the carbonyl carbon and amino nitrogen atoms which participate in the peptide bonds. Among the 150 or so amino acids which occur in nature, alpha, beta, gamma and delta amino acids are known. These have 1-4 intermediary carbons. Only alpha amino acids occur in proteins. Proline is a special case of an alpha amino acid; its side chain also binds to the peptide bond nitrogen.

For beta and higher order amino acids, there is a choice as to which main chain core carbon a side chain other than H is attached to. The preferred attachment site is the C-2 (alpha) carbon, i.e., the one adjacent to the carboxyl carbon of the -CO linking functionality. It is also possible for more than one main chain atom to carry a side chain other than H. However, in a preferred embodiment, only one main chain core atom carries a side chain other than H.

A main chain carbon atom may carry either one or two side chains; one is more common. A side chain may be attached to a main chain carbon atom by a single or a double bond; the former is more common.

A simple combinatorial peptide library is one whose members are peptides having three or more amino acids connected via peptide bonds.

The peptides may be linear, branched, or cyclic, and may covalently or noncovalently include nonpeptidyl moieties. The amino acids are not limited to the naturally occurring or to the genetically encoded amino acids.

A biased peptide library is one in which one or more (but not all) residues of the peptides are constant residues.

### *Cyclic Peptides*

Many naturally occurring peptides are cyclic. Cyclization is a common mechanism for stabilization of peptide conformation thereby achieving improved association of the peptide with its ligand and hence improved biological activity. Cyclization is usually achieved by intra-chain cystine formation, by formation of peptide bond between side chains or between N- and C- terminals. Cyclization was usually achieved by peptides in solution, but several publications have appeared that describe cyclization of peptides on beads.

A peptide library may be an oligopeptide library or a protein library.

### *Oligopeptides*

Preferably, the oligopeptides are at least five, six, seven or eight amino acids in length. Preferably, they are composed of less than 50, more preferably less than 20 amino acids.

In the case of an oligopeptide library, all or just some of the residues may be variable. The oligopeptide may be unconstrained, or constrained to a particular conformation by, e.g., the participation of constant cysteine residues in the formation of a constraining disulfide bond.

### *Proteins*

Proteins, like oligopeptides, are composed of a plurality of amino acids, but the term protein is usually reserved for longer peptides, which are able to fold into a stable conformation. A protein may be composed of two or more polypeptide chains, held together by covalent or noncovalent crosslinks. These may occur in a homooligomeric or a heterooligomeric state.

A peptide is considered a protein if it (1) is at least 50 amino acids long, or (2) has at least two stabilizing covalent crosslinks (e.g., disulfide bonds). Thus, conotoxins are considered proteins.

Usually, the proteins of a protein library will be characterizable as having both constant residues (the same for all proteins in the library) and variable residues (which vary from member to member). This is simply because, for a given range of variation at each position, the sequence space (simple diversity) grows exponentially with the number of residue positions, so at some point it becomes inconvenient for all residues of a peptide to be variable positions. Since proteins are usually larger than oligopeptides, it is more common for protein libraries than oligopeptide libraries to feature variable positions.

In the case of a protein library, it is desirable to focus the mutations at those sites which are tolerant of mutation. These may be determined by alanine scanning mutagenesis or by comparison of the protein sequence to that of homologous proteins of similar activity. It is also more likely that mutation of surface residues will directly affect binding. Surface residues may be determined by inspecting a 3D structure of the protein, or by labeling the surface and then ascertaining which residues have received labels. They may also be inferred by identifying regions of high hydrophilicity within the protein.

Because proteins are often altered at some sites but not others, protein libraries can be considered a special case of the biased peptide library.

There are several reasons that one might screen a protein library instead of an oligopeptide library, including (1) a particular protein, mutated in the library, has the desired activity to some degree already, and (2) the oligopeptides are not expected to have a sufficiently high affinity or specificity since they do not have a stable conformation.

When the protein library is based on a parental protein which does not have the desired activity, the parental protein will usually be one which is of high stability (melting point  $\geq 50$  deg. C.) and/or possessed of hypervariable regions.

The variable domains of an antibody possess hypervariable regions and hence, in some embodiments, the protein library comprises members which comprise a mutant of VH or VL chain, or a mutant of an antigen-specific binding fragment of such a chain. VH and VL chains are usually each about 110 amino acid residues, and are held in proximity by a disulfide bond between the adjoining CL and CH1 regions to form a variable domain. Together, the VH, VL, CL and CH1 form an Fab fragment.

In human heavy chains, the hypervariable regions are at 31-35, 49-65, 98-111 and 84-88, but only the first three are involved in antigen binding. There is variation among VH and VL chains at residues outside the hypervariable regions, but to a much lesser degree.

A sequence is considered a mutant of a VH or VL chain if it is at least 80% identical to a naturally occurring VH or VL chain at all residues outside the hypervariable region.

In a preferred embodiment, such antibody library members comprise both at least one VH chain and at least one VL chain, at least one of which is a mutant chain, and which chains may be derived from the same or different antibodies. The VH and VL chains may be covalently joined by a suitable linker moiety, as in a "single chain antibody", or they may be noncovalently joined, as in a naturally occurring variable domain.

If the joining is noncovalent, and the library is displayed on cells or virus, then either the VH or the VL chain may be fused to the carrier surface/coat protein. The complementary chain may be co-expressed, or added exogenously to the library.

The members may further comprise some or all of an antibody constant heavy and/or constant light chain, or a mutant thereof.

#### Peptoid Library

A peptoid is an analogue of a peptide in which one or more of the peptide bonds (-NH-CO-) are replaced by

pseudopeptide bonds, which may be the same or different. It is not necessary that all of the peptide bonds be replaced, i.e., a peptoid may include one or more conventional amino acid residues, e.g., proline.

5 A peptide bond has two small divalent linker elements, -NH- and -CO-. Thus, a preferred class of pseudopeptide bonds are those which consist of two small divalent linker elements. Each may be chosen independently from the group consisting of amine (-NH-), substituted amine (-NR-),  
 10 carbonyl (-CO-), thiocarbonyl (-CS-), methylene (-CH<sub>2</sub>-), monosubstituted methylene (-CHR-), disubstituted methylene (-CR<sub>1</sub>R<sub>2</sub>-), ether (-O-) and thioether (-S-). The more preferred pseudopeptide bonds include:

N-modified -NRCO-

15 Carba Ψ -CH<sub>2</sub>-CH<sub>2</sub>-

Depsi Ψ -CO-O-

Hydroxyethylene Ψ -CHOH-CH<sub>2</sub>-

Ketomethylene Ψ -CO-CH<sub>2</sub>-

Methylene-Oxy -CH<sub>2</sub>-O-

20 Reduced -CH<sub>2</sub>-NH-

Thiomethylene -CH<sub>2</sub>-S-

Thiopeptide -CS-NH-

Retro-Inverso -CO-NH-

25 A single peptoid molecule may include more than one kind of pseudopeptide bond.

For the purposes of introducing diversity into a peptoid library, one may vary (1) the side chains attached to the core main chain atoms of the monomers linked by the  
 30 pseudopeptide bonds, and/or (2) the side chains (e.g., the -R of an -NRCO-) of the pseudopeptide bonds. Thus, in one embodiment, the monomeric units which are not amino acid residues are of the structure -NR<sub>1</sub>-CR<sub>2</sub>-CO-, where at least one of R<sub>1</sub> and R<sub>2</sub> are not hydrogen. If there is variability  
 35 in the pseudopeptide bond, this is most conveniently done by using an -NRCO- or other pseudopeptide bond with an R group, and varying the R group. In this event, the R group will

usually be any of the side chains characterizing the amino acids of peptides, as previously discussed.

If the R group of the pseudopeptide bond is not variable, it will usually be small, e.g., not more than 10 atoms (e.g., hydroxyl, amino, carboxyl, methyl, ethyl, propyl).

If the conjugation chemistries are compatible, a simple combinatorial library may include both peptides and peptoids.

#### Peptide Nucleic Acid Library

A PNA oligomer is here defined as one comprising a plurality of units, at least one of which is a PNA monomer which comprises a side chain comprising a nucleobase. For nucleobases, see USP 6,077,835.

The classic PNA oligomer is composed of (2-aminoethyl)glycine units, with nucleobases attached by methylene carbonyl linkers. That is, it has the structure



where the outer parenthesized substructure is the PNA monomer.

In this structure, the nucleobase B is separated from the backbone N by three bonds, and the points of attachment of the side chains are separated by six bonds. The nucleobase may be any of the bases included in the nucleotides discussed in connection with oligonucleotide libraries. The bases of nucleotides A, G, T, C and U are preferred.

A PNA oligomer may further comprise one or more amino acid residues, especially glycine and proline.

One can readily envision related molecules in which (1) the -COCH<sub>2</sub>- linker is replaced by another linker, especially one composed of two small divalent linkers as defined previously, (2) a side chain is attached to one of the three main chain carbons not participating in the peptide bond

(either instead or in addition to the side chain attached to the N of the classic PNA); and/or (3) the peptide bonds are replaced by pseudopeptide bonds as disclosed previously in the context of peptoids.

5 PNA oligomer libraries have been made; see e.g. Cook, 6,204,326.

#### Small Organic Compound Library

10 The small organic compound library ("compound library", for short) is a combinatorial library whose members are suitable for use as drugs if, indeed, they have the ability to mediate a biological activity of the target protein.

15 Peptides have certain disadvantages as drugs. These include susceptibility to degradation by serum proteases, and difficulty in penetrating cell membranes. Preferably, all or most of the compounds of the compound library avoid, or at least do not suffer to the same degree, one or more of the pharmaceutical disadvantages of peptides.

20 In designing a compound library, it is helpful to bear in mind the methods of molecular modification typically used to obtain new drugs. Three basic kinds of modification may be identified: disjunction, in which a lead drug is simplified to identify its component pharmacophoric moieties; conjunction, in which two or more known  
25 pharmacophoric moieties, which may be the same or different, are associated, covalently or noncovalently, to form a new drug; and alteration, in which one moiety is replaced by another which may be similar or different, but which is not in effect a disjunction or conjunction. The use of the  
30 terms "disjunction", "conjunction" and "alteration" is intended only to connote the structural relationship of the end product to the original leads, and not how the new drugs are actually synthesized, although it is possible that the two are the same.

35 The process of disjunction is illustrated by the evolution of neostigmine (1931) and edrophonium (1952) from physostigmine (1925). Subsequent conjunction is illustrated by demecarium (1956) and ambenonium (1956).

Alterations may modify the size, polarity, or electron distribution of an original moiety. Alterations include ring closing or opening, formation of lower or higher homologues, introduction or saturation of double bonds, introduction of optically active centers, introduction, removal or replacement of bulky groups, isosteric or bioisosteric substitution, changes in the position or orientation of a group, introduction of alkylating groups, and introduction, removal or replacement of groups with a view toward inhibiting or promoting inductive (electrostatic) or conjugative (resonance) effects.

Thus, the substituents may include electron acceptors and/or electron donors. Typical electron donors (+I) include  $-\text{CH}_3$ ,  $-\text{CH}_2\text{R}$ ,  $-\text{CHR}_2$ ,  $-\text{CR}_3$  and  $-\text{COO}^-$ . Typical electron acceptors (-I) include  $-\text{NH}_3^+$ ,  $-\text{NR}_3^+$ ,  $-\text{NO}_2$ ,  $-\text{CN}$ ,  $-\text{COOH}$ ,  $-\text{COOR}$ ,  $-\text{CHO}$ ,  $-\text{COR}$ ,  $-\text{COR}$ ,  $-\text{F}$ ,  $-\text{Cl}$ ,  $-\text{Br}$ ,  $-\text{OH}$ ,  $-\text{OR}$ ,  $-\text{SH}$ ,  $-\text{SR}$ ,  $-\text{CH}=\text{CH}_2$ ,  $-\text{CR}=\text{CR}_2$ , and  $-\text{C}=\text{CH}$ .

The substituents may also include those which increase or decrease electronic density in conjugated systems. The former (+R) groups include  $-\text{CH}_3$ ,  $-\text{CR}_3$ ,  $-\text{F}$ ,  $-\text{Cl}$ ,  $-\text{Br}$ ,  $-\text{I}$ ,  $-\text{OH}$ ,  $-\text{OR}$ ,  $-\text{OCOR}$ ,  $-\text{SH}$ ,  $-\text{SR}$ ,  $-\text{NH}_2$ ,  $-\text{NR}_2$ , and  $-\text{NHCOR}$ . The latter (-R) groups include  $-\text{NO}_2$ ,  $-\text{CN}$ ,  $-\text{CHC}$ ,  $-\text{COR}$ ,  $-\text{COOH}$ ,  $-\text{COOR}$ ,  $-\text{CONH}_2$ ,  $-\text{SO}_2\text{R}$  and  $-\text{CF}_3$ .

Synthetically speaking, the modifications may be achieved by a variety of unit processes, including nucleophilic and electrophilic substitution, reduction and oxidation, addition elimination, double bond cleavage, and cyclization.

For the purpose of constructing a library, a compound, or a family of compounds, having one or more pharmacological activities (which need not be related to the known or suspected activities of the target protein), may be disjoined into two or more known or potential pharmacophoric moieties. Analogues of each of these moieties may be identified, and mixtures of these analogues reacted so as to reassemble compounds which have some similarity to the original lead compound. It is not necessary that all



members of the library possess moieties analogous to all of the moieties of the lead compound.

The design of a library may be illustrated by the example of the benzodiazepines. Several benzodiazepine drugs, including chlordiazepoxide, diazepam and oxazepam, have been used as anti-anxiety drugs. Derivatives of benzodiazepines have widespread biological activities; derivatives have been reported to act not only as anxiolytics, but also as anticonvulsants; cholecystokinin (CCK) receptor subtype A or B, kappa opioid receptor, platelet activating factor, and HIV transactivator Tat antagonists, and GPIIbIIIa, reverse transcriptase and ras farnesyltransferase inhibitors.

The benzodiazepine structure has been disjoined into a 2-aminobenzophenone, an amino acid, and an alkylating agent. See Bunin, et al., Proc. Nat. Acad. Sci. USA, 91:4708 (1994). Since only a few 2-aminobenzophenone derivatives are commercially available, it was later disjoined into 2-aminoarylstannane, an acid chloride, an amino acid, and an alkylating agent. Bunin, et al., Meth. Enzymol., 267:448 (1996). The arylstannane may be considered the core structure upon which the other moieties are substituted, or all four may be considered equals which are conjoined to make each library member.

A basic library synthesis plan and member structure is shown in Figure 1 of Fowlkes, et al., U.S. Serial No. 08/740,671, incorporated by reference in its entirety. The acid chloride building block introduces variability at the  $R^1$  site. The  $R^2$  site is introduced by the amino acid, and the  $R^3$  site by the alkylating agent. The  $R^4$  site is inherent in the arylstannane. Bunin, et al. generated a 1, 4-benzodiazepine library of 11,200 different derivatives prepared from 20 acid chlorides, 35 amino acids, and 16 alkylating agents. (No diversity was introduced at  $R^4$ ; this group was used to couple the molecule to a solid phase.) According to the Available Chemicals Directory (HDL Information Systems, San Leandro CA), over 300 acid chlorides, 80 Fmoc-protected amino acids and 800 alkylating

agents were available for purchase (and more, of course, could be synthesized). The particular moieties used were chosen to maximize structural dispersion, while limiting the numbers to those conveniently synthesized in the wells of a microtiter plate. In choosing between structurally similar compounds, preference was given to the least substituted compound.

The variable elements included both aliphatic and aromatic groups. Among the aliphatic groups, both acyclic and cyclic (mono- or poly-) structures, substituted or not, were tested. (While all of the acyclic groups were linear, it would have been feasible to introduce a branched aliphatic). The aromatic groups featured either single and multiple rings, fused or not, substituted or not, and with heteroatoms or not. The secondary substituents included -NH<sub>2</sub>, -OH, -OMe, -CN, -Cl, -F, and -COOH. While not used, spacer moieties, such as -O-, -S-, -OO-, -CS-, -NH-, and -NR-, could have been incorporated.

Bunin et al. suggest that instead of using a 1, 4-benzodiazepine as a core structure, one may instead use a 1, 4-benzodiazepine-2, 5-dione structure.

As noted by Bunin et al., it is advantageous, although not necessary, to use a linkage strategy which leaves no trace of the linking functionality, as this permits construction of a more diverse library.

Other combinatorial nonoligomeric compound libraries known or suggested in the art have been based on carbamates, mercaptoacylated pyrrolidines, phenolic agents, aminimides, N-acylamino ethers (made from amino alcohols, aromatic hydroxy acids, and carboxylic acids), N-alkylamino ethers (made from aromatic hydroxy acids, amino alcohols and aldehydes) 1, 4-piperazines, and 1, 4-piperazine-6-ones.

DeWitt, et al., Proc. Nat. Acad. Sci. (USA), 90:6909-13 (1993) describe the simultaneous but separate, synthesis of 40 discrete hydantoins and 40 discrete benzodiazepines. They carry out their synthesis on a solid support (inside a gas dispersion tube), in an array format, as opposed to other conventional simultaneous synthesis techniques (e.g.,

in a well, or on a pin). The hydantoins were synthesized by first simultaneously deprotecting and then treating each of five amino acid resins with each of eight isocyanates. The benzodiazepines were synthesized by treating each of five deprotected amino acid resins with each of eight 2-amino benzophenone imines.

Chen, et al., J. Am. Chem. Soc., 116:2661-62 (1994) described the preparation of a pilot (9 member) combinatorial library of formate esters. A polymer bead-bound aldehyde preparation was "split" into three aliquots, each reacted with one of three different ylide reagents. The reaction products were combined, and then divided into three new aliquots, each of which was reacted with a different Michael donor. Compound identity was found to be determinable on a single bead basis by gas chromatography/mass spectroscopy analysis.

Holmes, USP 5,549,974 (1996) sets forth methodologies for the combinatorial synthesis of libraries of thiazolidinones and metathiazanones. These libraries are made by combination of amines, carbonyl compounds, and thiols under cyclization conditions.

Ellman, USP 5,545,568 (1996) describes combinatorial synthesis of benzodiazepines, prostaglandins, beta-turn mimetics, and glycerol-based compounds. See also Ellman, USP 5,288,514.

Summerton, USP 5,506,337 (1996) discloses methods of preparing a combinatorial library formed predominantly of morpholino subunit structures.

Heterocyclic combinatorial libraries are reviewed generally in Nefzi, et al., Chem. Rev., 97:449-472 (1997).

For pharmacological classes, see, e.g., Goth, Medical Pharmacology: Principles and Concepts (C.V. Mosby Co.: 8th ed. 1976); Korolkovas and Burckhalter, Essentials of Medicinal Chemistry (John Wiley & Sons, Inc.: 1976). For synthetic methods, see, e.g., Warren, Organic Synthesis: The Disconnection Approach (John Wiley & Sons, Ltd.: 1982); Fuson, Reactions of Organic Compounds (John Wiley & Sons:

1966); Payne and Payne, How to do an Organic Synthesis (Allyn and Bacon, Inc.: 1969); Greene, Protective Groups in Organic Synthesis (Wiley-Interscience). For selection of substituents, see e.g., Hansch and Leo, Substituent Constants for Correlation Analysis in Chemistry and Biology (John Wiley & Sons: 1979).

The library is preferably synthesized so that the individual members remain identifiable so that, if a member is shown to be active, it is not necessary to analyze it.

Several methods of identification have been proposed, including:

- (1) encoding, i.e., the attachment to each member of an identifier moiety which is more readily identified than the member proper. This has the disadvantage that the tag may itself influence the activity of the conjugate.
- (2) spatial addressing, e.g., each member is synthesized only at a particular coordinate on or in a matrix, or in a particular chamber. This might be, for example, the location of a particular pin, or a particular well on a microtiter plate, or inside a "tea bag".

The present invention is not limited to any particular form of identification.

However, it is possible to simply characterize those members of the library which are found to be active, based on the characteristic spectroscopic indicia of the various building blocks.

Solid phase synthesis permits greater control over which derivatives are formed. However, the solid phase could interfere with activity. To overcome this problem, some or all of the molecules of each member could be liberated, after synthesis but before screening.

Examples of candidate simple libraries which might be evaluated include derivatives of the following:

Cyclic Compounds Containing One Hetero Atom  
Heteronitrogen  
pyrroles

|    |                                                |
|----|------------------------------------------------|
|    | pentasubstituted pyrroles                      |
|    | pyrrolidines                                   |
|    | pyrrolines                                     |
|    | prolines                                       |
| 5  | indoles                                        |
|    | beta-carbolines                                |
|    | pyridines                                      |
|    | dihydropyridines                               |
|    | 1,4-dihydropyridines                           |
| 10 | pyrido[2,3-d]pyrimidines                       |
|    | tetrahydro-3H-imidazo[4,5-c] pyridines         |
|    | Isoquinolines                                  |
|    | tetrahydroisoquinolines                        |
|    | quinolones                                     |
| 15 | beta-lactams                                   |
|    | azabicyclo[4.3.0]nonen-8-one amino acid        |
|    | Heterooxygen                                   |
|    | furans                                         |
|    | tetrahydrofurans                               |
| 20 | 2,5-disubstituted tetrahydrofurans             |
|    | pyrans                                         |
|    | hydroxypyranones                               |
|    | tetrahydroxypyranones                          |
|    | gamma-butyrolactones                           |
| 25 | Heterosulfur                                   |
|    | sulfolenes                                     |
|    | Cyclic Compounds with Two or More Hetero atoms |
|    | Multiple heteronitrogens                       |
|    | imidazoles                                     |
| 30 | pyrazoles                                      |
|    | piperazines                                    |
|    | diketopiperazines                              |
|    | arylpiperazines                                |
|    | benzylpiperazines                              |
| 35 | benzodiazepines                                |
|    | 1,4-benzodiazepine-2,5-diones                  |
|    | hydantoins                                     |
|    | 5-alkoxyhydantoins                             |

dihydropyrimidines

1,3-disubstituted-5,6-dihydropyrimidine-2,4-  
diones

5

cyclic ureas

cyclic thioureas

quinazolines

chiral 3-substituted-quinazoline-2,4-

diones

10

triazoles

1,2,3-triazoles

purines

Heteronitrogen and Heterooxygen

dikelomorpholines

15

isoxazoles

isoxazolines

Heteronitrogen and Heterosulfur

thiazolidines

N-axylthiazolidines

20

dihydrothiazoles

2-methylene-2,3-dihydrothiazates

2-aminothiazoles

thiophenes

3-amino thiophenes

25

4-thiazolidinones

4-melathiazanones

benzisothiazolones

For details on synthesis of libraries, see Nefzi, et  
al., Chem. Rev., 97:449-72 (1997), and references cited  
therein.

30

### Pharmaceutical Methods and Preparations

The preferred animal subject of the present invention  
is a mammal. By the term "mammal" is meant an individual  
belonging to the class Mammalia. The invention is  
particularly useful in the treatment of human subjects,  
although it is intended for veterinary and nutritional uses  
as well. Preferred nonhuman subjects are of the orders

35

Primata (e.g., apes and monkeys), Artiodactyla or Perissodactyla (e.g., cows, pigs, sheep, horses, goats), Carnivora (e.g., cats, dogs), Rodenta (e.g., rats, mice, guinea pigs, hamsters), Lagomorpha (e.g., rabbits) or other pet, farm or laboratory mammals.

The term "protection", as used herein, is intended to include "prevention," "suppression" and "treatment."

"Prevention", strictly speaking, involves administration of the pharmaceutical prior to the induction of the disease (or other adverse clinical condition). "Suppression" involves administration of the composition prior to the clinical appearance of the disease. "Treatment" involves administration of the protective composition after the appearance of the disease.

It will be understood that in human and veterinary medicine, it is not always possible to distinguish between "preventing" and "suppressing" since the ultimate inductive event or events may be unknown, latent, or the patient is not ascertained until well after the occurrence of the event or events. Therefore, unless qualified, the term "prevention" will be understood to refer to both prevention in the strict sense, and to suppression.

The preventative or prophylactic use of a pharmaceutical involves identifying subjects who are at higher risk than the general population of contracting the disease, and administering the pharmaceutical to them in advance of the clinical appearance of the disease. The effectiveness of such use is measured by comparing the subsequent incidence or severity of the disease, or of particular symptoms of the disease, in the treated subjects against that in untreated subjects of the same high risk group.

While high risk factors vary from disease to disease, in general, these include (1) prior occurrence of the disease in one or more members of the same family, or, in the case of a contagious disease, in individuals with whom the subject has come into potentially contagious contact at a time when the earlier victim was likely to be contagious,

(2) a prior occurrence of the disease in the subject, (3) prior occurrence of a related disease, or a condition known to increase the likelihood of the disease, in the subject; (4) appearance of a suspicious level of a marker of the disease, or a related disease or condition; (5) a subject who is immunologically compromised, e.g., by radiation treatment, HIV infection, drug use,, etc., or (6) membership in a particular group (e.g., a particular age, sex, race, ethnic group, etc.) which has been epidemiologically associated with that disease.

A prophylaxis or treatment may be curative, that is, directed at the underlying cause of a disease, or ameliorative, that is, directed at the symptoms of the disease, especially those which reduce the quality of life.

It should also be understood that to be useful, the protection provided need not be absolute, provided that it is sufficient to carry clinical value. An agent which provides protection to a lesser degree than do competitive agents may still be of value if the other agents are ineffective for a particular individual, if it can be used in combination with other agents to enhance the level of protection, or if it is safer than competitive agents. It is desirable that there be a statistically significant ( $p=0.05$  or less) improvement in the treated subject relative to an appropriate untreated control, and it is desirable that this improvement be at least 10%, more preferably at least 25%, still more preferably at least 50%, even more preferably at least 100%, in some indicia of the incidence or severity of the disease or of at least one symptom of the disease.

At least one of the drugs of the present invention may be administered, by any means that achieve their intended purpose, to protect a subject against a disease or other adverse condition. The form of administration may be systemic or topical. For example, administration of such a composition may be by various parenteral routes such as subcutaneous, intravenous, intradermal, intramuscular, intraperitoneal, intranasal, transdermal, or buccal routes. Alternatively, or concurrently, administration may be by the



oral route. Parenteral administration can be by bolus injection or by gradual perfusion over time.

A typical regimen comprises administration of an effective amount of the drug, administered over a period ranging from a single dose, to dosing over a period of hours, days, weeks, months, or years.

It is understood that the suitable dosage of a drug of the present invention will be dependent upon the age, sex, health, and weight of the recipient, kind of concurrent treatment, if any, frequency of treatment, and the nature of the effect desired. However, the most preferred dosage can be tailored to the individual subject, as is understood and determinable by one of skill in the art, without undue experimentation. This will typically involve adjustment of a standard dose, e.g., reduction of the dose if the patient has a low body weight.

Prior to use in humans, a drug will first be evaluated for safety and efficacy in laboratory animals. In human clinical studies, one would begin with a dose expected to be safe in humans, based on the preclinical data for the drug in question, and on customary doses for analogous drugs (if any). If this dose is effective, the dosage may be decreased, to determine the minimum effective dose, if desired. If this dose is ineffective, it will be cautiously increased, with the patients monitored for signs of side effects. See, e.g., Berkow et al, eds., *The Merck Manual*, 15th edition, Merck and Co., Rahway, N.J., 1987; Goodman et al., eds., *Goodman and Gilman's The Pharmacological Basis of Therapeutics*, 8th edition, Pergamon Press, Inc., Elmsford, N.Y., (1990); Avery's *Drug Treatment: Principles and Practice of Clinical Pharmacology and Therapeutics*, 3rd edition, ADIS Press, LTD., Williams and Wilkins, Baltimore, MD. (1987), Ebadi, *Pharmacology*, Little, Brown and Co., Boston, (1985), which references and references cited therein, are entirely incorporated herein by reference.

The total dose required for each treatment may be administered by multiple doses or in a single dose. The protein may be administered alone or in conjunction with

other therapeutics directed to the disease or directed to other symptoms thereof.

Typical pharmaceutical doses, for adult humans, are in the range of 1 ng to 10g per day, more often 1 mg to 1g per day.

The appropriate dosage form will depend on the disease, the pharmaceutical, and the mode of administration; possibilities include tablets, capsules, lozenges, dental pastes, suppositories, inhalants, solutions, ointments and parenteral depots. See, e.g., Berker, *supra*, Goodman, *supra*, Avery, *supra* and Ebadi, *supra*, which are entirely incorporated herein by reference, including all references cited therein.

In the case of peptide drugs, the drug may be administered in the form of an expression vector comprising a nucleic acid encoding the peptide; such a vector, after incorporation into the genetic complement of a cell of the patient, directs synthesis of the peptide. Suitable vectors include genetically engineered poxviruses (vaccinia), adenoviruses, adeno-associated viruses, herpesviruses and lentiviruses which are or have been rendered nonpathogenic.

In addition to at least one drug as described herein, a pharmaceutical composition may contain suitable pharmaceutically acceptable carriers, such as excipients, carriers and/or auxiliaries which facilitate processing of the active compounds into preparations which can be used pharmaceutically. See, e.g., Berker, *supra*, Goodman, *supra*, Avery, *supra* and Ebadi, *supra*, which are entirely incorporated herein by reference, included all references cited therein.

## **Assay Compositions and Methods**

### Target Organism

The invention contemplates that it may be appropriate to ascertain or to mediate the biological activity of a substance of this invention in a target organism.

The target organism may be a plant, animal, or microorganism.

In the case of a plant, it may be an economic plant, in which case the drug may be intended to increase the disease, weather or pest resistance, alter the growth characteristics, or otherwise improve the useful

5 characteristics or mute undesirable characteristics of the plant. Or it may be a weed, in which case the drug may be intended to kill or otherwise inhibit the growth of the plant, or to alter its characteristics to convert it from a weed to an economic plant. The plant may be a tree, shrub,  
10 crop, grass, etc. The plant may be an algae (which are in some cases also microorganisms), or a vascular plant, especially gymnosperms (particularly conifers) and angiosperms. Angiosperms may be monocots or dicots. The plants of greatest interest are rice, wheat, corn, alfalfa,  
15 soybeans, potatoes, peanuts, tomatoes, melons, apples, pears, plums, pineapples, fir, spruce, pine, cedar, and oak.

If the target organism is a microorganism, it may be algae, bacteria, fungi, or a virus (although the biological activity of a virus must be determined in a virus-infected  
20 cell). The microorganism may be human or other animal or plant pathogen, or it may be nonpathogenic. It may be a soil or water organism, or one which normally lives inside other living things.

If the target organism is an animal, it may be a  
25 vertebrate or a nonvertebrate animal. Nonvertebrate animals are chiefly of interest when they act as pathogens or parasites, and the drugs are intended to act as biocidal or biostatic agents. Nonvertebrate animals of interest include worms, mollusks, and arthropods.

30 The target organism may also be a vertebrate animal, i.e., a mammal, bird, reptile, fish or amphibian. Among mammals, the target animal preferably belongs to the order Primata (humans, apes and monkeys), Artiodactyla (e.g., cows, pigs, sheep, goats, horses), Rodenta (e.g., mice,  
35 rats) Lagomorpha (e.g., rabbits, hares), or Carnivora (e.g., cats, dogs). Among birds, the target animals are preferably of the orders Anseriformes (e.g., ducks, geese, swans) or Galliformes (e.g., quails, grouse, pheasants, turkeys and

chickens). Among fish, the target animal is preferably of the order Clupeiformes (e.g., sardines, shad, anchovies, whitefish, salmon).

## 5 Target Tissues

The term "target tissue" refers to any whole animal, physiological system, whole organ, part of organ, miscellaneous tissue, cell, or cell component (e.g., the cell membrane) of a target animal in which biological  
10 activity may be measured.

Routinely in mammals one would choose to compare and contrast the biological impact on virtually any and all tissues which express the subject receptor protein. The main tissues to use are: brain, heart, lung, kidney, liver,  
15 pancreas, skin, intestines, adipose, stomach, skeletal muscle, adrenal glands, breast, prostate, vasculature, retina, cornea, thyroid gland, parathyroid glands, thymus, bone marrow, bone, etc.

Another classification would be by cell type: B cells,  
20 T cells, macrophages, neutrophils, eosinophils, mast cells, platelets, megakaryocytes, erythrocytes, bone marrow stromal cells, fibroblasts, neurons, astrocytes, neuroglia, microglia, epithelial cells (from any organ, e.g. skin, breast, prostate, lung, intestines etc), cardiac muscle  
25 cells, smooth muscle cells, striated muscle cells, osteoblasts, osteocytes, chondroblasts, chondrocytes, keratinocytes, melanocytes, etc.

Of course, in the case of a unicellular organism, there is no distinction between the "target organism" and the  
30 "target tissue".

## Screening Assays

Assays intended to determine the binding or the biological activity of a substance are called preliminary  
35 screening assays.

Screening assays will typically be either in vitro (cell-free) assays (for binding to an immobilized receptor) or cell-based assays (for alterations in the phenotype of

the cell). They will not involve screening of whole multicellular organisms, or isolated organs. The comments on diagnostic biological assays apply mutatis mutandis to screening cell-based assays.

5

#### In Vitro vs. In Vivo Assays

The term *in vivo* is descriptive of an event, such as binding or enzymatic action, which occurs within a living organism. The organism in question may, however, be  
10 genetically modified. The term *in vitro* refers to an event which occurs outside a living organism. Parts of an organism (e.g., a membrane, or an isolated biochemical) are used, together with artificial substrates and/or conditions. For the purpose of the present invention, the term *in vitro*  
15 excludes events occurring inside or on an intact cell, whether of a unicellular or multicellular organism.

*In vivo* assays include both cell-based assays, and organismic assays. The cell-based assays include both assays on unicellular organisms, and assays on isolated cells or  
20 cell cultures derived from multicellular organisms. The cell cultures may be mixed, provided that they are not organized into tissues or organs. The term organismic assay refers to assays on whole multicellular organisms, and assays on isolated organs or tissues of such organisms.

25

#### In vitro Diagnostic Methods and Reagents

The *in vitro* assays of the present invention may be applied to any suitable analyte-containing sample, and may  
30 be qualitative or quantitative in nature.

#### *Sample*

The sample will normally be a biological fluid, such as blood, urine, lymph, semen, milk, or cerebrospinal fluid, or  
35 a fraction or derivative thereof, or a biological tissue, in the form of, e.g., a tissue section or homogenate. However, the sample conceivably could be (or derived from) a food or beverage, a pharmaceutical or diagnostic composition, soil,

or surface or ground water. If a biological fluid or tissue, it may be taken from a human or other mammal, vertebrate or animal, or from a plant. The preferred sample is blood, or a fraction or derivative thereof.

5

#### *Binding and Reaction Assays*

The assay may be a binding assay, in which one step involves the binding of a diagnostic reagent to the analyte, or a reaction assay, which involves the reaction of a reagent with the analyte. The reagents used in a binding assay may be classified as to the nature of their interaction with analyte: (1) analyte analogues, or (2) analyte binding molecules (ABM). They may be labeled or insolubilized.

10

In a reaction assay, the assay may look for a direct reaction between the analyte and a reagent which is reactive with the analyte, or if the analyte is an enzyme or enzyme inhibitor, for a reaction catalyzed or inhibited by the analyte. The reagent may be a reactant, a catalyst, or an inhibitor for the reaction.

15

An assay may involve a cascade of steps in which the product of one step acts as the target for the next step. These steps may be binding steps, reaction steps, or a combination thereof.

20

#### *Signal Producing System (SPS)*

In order to detect the presence, or measure the amount, of an analyte, the assay must provide for a signal producing system (SPS) in which there is a detectable difference in the signal produced, depending on whether the analyte is present or absent (or, in a quantitative assay, on the amount of the analyte). The detectable signal may be one which is visually detectable, or one detectable only with instruments. Possible signals include production of colored or luminescent products, alteration of the characteristics (including amplitude or polarization) of absorption or emission of radiation by an assay component or product, and

25

30

35

precipitation or agglutination of a component or product. The term "signal" is intended to include the discontinuance of an existing signal, or a change in the rate of change of an observable parameter, rather than a change in its absolute value. The signal may be monitored manually or automatically.

In a reaction assay, the signal is often a product of the reaction. In a binding assay, it is normally provided by a label borne by a labeled reagent.

### *Labels*

The component of the signal producing system which is most intimately associated with the diagnostic reagent is called the "label". A label may be, e.g., a radioisotope, a fluorophore, an enzyme, a co-enzyme, an enzyme substrate, an electron-dense compound, an agglutinable particle.

The radioactive isotope can be detected by such means as the use of a gamma counter or a scintillation counter or by autoradiography. Isotopes which are particularly useful for the purpose of the present invention include  $^3\text{H}$ ,  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{35}\text{S}$ ,  $^{14}\text{C}$ ,  $^{32}\text{P}$  and  $^{33}\text{P}$ .  $^{125}\text{I}$  is preferred for antibody labeling.

The label may also be a fluorophore. When the fluorescently labeled reagent is exposed to light of the proper wave length, its presence can then be detected due to fluorescence. Among the most commonly used fluorescent labeling compounds are fluorescein isothiocyanate, rhodamine, phycoerythrin, phycocyanin, allophycocyanin, o-phthalaldehyde and fluorescamine.

Alternatively, fluorescence-emitting metals such as  $^{125}\text{Eu}$ , or others of the lanthanide series, may be incorporated into a diagnostic reagent using such metal chelating groups as diethylenetriaminepentaacetic acid (DTPA) or ethylenediamine-tetraacetic acid (EDTA).

The label may also be a chemiluminescent compound. The presence of the chemiluminescently labeled reagent is then determined by detecting the presence of luminescence that arises during the course of a chemical reaction. Examples

of particularly useful chemiluminescent labeling compounds are luminol, isolumino, theromatic acridinium ester, imidazole, acridinium salt and oxalate ester.

Likewise, a bioluminescent compound may be used for labeling. Bioluminescence is a type of chemiluminescence found in biological systems in which a catalytic protein increases the efficiency of the chemiluminescent reaction. The presence of a bioluminescent protein is determined by detecting the presence of luminescence. Important bioluminescent compounds for purposes of labeling are luciferin, luciferase and aequorin.

Enzyme labels, such as horseradish peroxidase and alkaline phosphatase, are preferred. When an enzyme label is used, the signal producing system must also include a substrate for the enzyme. If the enzymatic reaction product is not itself detectable, the SPS will include one or more additional reactants so that a detectable product appears.

An enzyme analyte may act as its own label if an enzyme inhibitor is used as a diagnostic reagent.

#### *Binding Assay Formats*

Binding assays may be divided into two basic types, heterogeneous and homogeneous. In heterogeneous assays, the interaction between the affinity molecule and the analyte does not affect the label, hence, to determine the amount or presence of analyte, bound label must be separated from free label. In homogeneous assays, the interaction does affect the activity of the label, and therefore analyte levels can be deduced without the need for a separation step.

In one embodiment, the ABM is insolubilized by coupling it to a macromolecular support, and analyte in the sample is allowed to compete with a known quantity of a labeled or specifically labelable analyte analogue. The "analyte analogue" is a molecule capable of competing with analyte for binding to the ABM, and the term is intended to include analyte itself. It may be labeled already, or it may be labeled subsequently by specifically binding the label to a moiety differentiating the analyte analogue from analyte.



The solid and liquid phases are separated, and the labeled analyte analogue in one phase is quantified. The higher the level of analyte analogue in the solid phase, i.e., sticking to the ABM, the lower the level of analyte in the sample.

In a "sandwich assay", both an insolubilized ABM, and a labeled ABM are employed. The analyte is captured by the insolubilized ABM and is tagged by the labeled ABM, forming a ternary complex. The reagents may be added to the sample in either order, or simultaneously. The ABMs may be the same or different. The amount of labeled ABM in the ternary complex is directly proportional to the amount of analyte in the sample.

The two embodiments described above are both heterogeneous assays. However, homogeneous assays are conceivable. The key is that the label be affected by whether or not the complex is formed.

#### Conjugation Methods

A label may be conjugated, directly or indirectly (e.g., through a labeled anti-ABM antibody), covalently (e.g., with SPDP) or noncovalently, to the ABM, to produce a diagnostic reagent. Similarly, the ABM may be conjugated to a solid phase support to form a solid phase ("capture") diagnostic reagent.

Suitable supports include glass, polystyrene, polypropylene, polyethylene, dextran, nylon, amylases, natural and modified celluloses, polyacrylamides, agaroses, and magnetite. The nature of the carrier can be either soluble to some extent or insoluble for the purposes of the present invention.

The support material may have virtually any possible structural configuration so long as the coupled molecule is capable of binding to its target. Thus the support configuration may be spherical, as in a bead, or cylindrical, as in the inside surface of a test tube, or the external surface of a rod. Alternatively, the surface may be flat such as a sheet, test strip, etc.

### Biological Assays

A biological assay measures or detects a biological response of a biological entity to a substance.

5 The biological entity may be a whole organism, an isolated organ or tissue, freshly isolated cells, an immortalized cell line, or a subcellular component (such as a membrane; this term should not be construed as including an isolated receptor). The entity may be, or may be derived from, an organism which occurs in nature, or which is  
10 modified in some way. Modifications may be genetic (including radiation and chemical mutants, and genetic engineering) or somatic (e.g., surgical, chemical, etc.). In the case of a multicellular entity, the modifications may affect some or all cells. The entity need not be the target  
15 organism, or a derivative thereof, if there is a reasonable correlation between bioassay activity in the assay entity and biological activity in the target organism.

The entity is placed in a particular environment, which may be more or less natural. For example, a culture medium  
20 may, but need not, contain serum or serum substitutes, and it may, but need not, include a support matrix of some kind, it may be still, or agitated. It may contain particular biological or chemical agents, or have particular physical parameters (e.g., temperature), that are intended to nourish  
25 or challenge the biological entity.

There must also be a detectable biological marker for the response. At the cellular level, the most common markers are cell survival and proliferation, cell behavior (clustering, motility), cell morphology (shape, color), and  
30 biochemical activity (overall DNA synthesis, overall protein synthesis, and specific metabolic activities, such as utilization of particular nutrients, e.g., consumption of oxygen, production of CO<sub>2</sub>, production of organic acids, uptake or discharge of ions).

35 The direct signal produced by the biological marker may be transformed by a signal producing system into a different signal which is more observable, for example, a fluorescent or colorimetric signal.

The entity, environment, marker and signal producing system are chosen to achieve a clinically acceptable level of sensitivity, specificity and accuracy.

5 In some cases, the goal will be to identify substances which mediate the biological activity of a natural biological entity, and the assay is carried out directly with that entity. In other cases, the biological entity is used simply as a model of some more complex (or otherwise inconvenient to work with) biological entity. In that  
10 event, the model biological entity is used because activity in the model system is considered more predictive of activity in the ultimate natural biological entity than is simple binding activity in an in vitro system. The model entity is used instead of the ultimate entity because the  
15 former is more expensive or slower to work with, or because ethical considerations forbid working with the ultimate entity yet.

The model entity may be naturally occurring, if the model entity usefully models the ultimate entity under some  
20 conditions. Or it may be non-naturally occurring, with modifications that increase its resemblance to the ultimate entity.

Transgenic animals, such as transgenic mice, rats, and rabbits, have been found useful as model systems.

25 In cell-based model assays, where the biological activity is mediated by binding to a receptor (target protein), the receptor may be functionally connected to a signal (biological marker) producing system, which may be endogenous or exogenous to the cell.

30 There are a number of techniques of doing this.

#### "Zero-Hybrid" Systems

In these systems, the binding of a peptide to the target protein results in a screenable or selectable  
35 phenotypic change, without resort to fusing the target protein (or a ligand binding moiety thereof) to an endogenous protein. It may be that the target protein is endogenous to the host cell, or is substantially identical

to an endogenous receptor so that it can take advantage of the latter's native signal transduction pathway. Or sufficient elements of the signal transduction pathway normally associated with the target protein may be engineered into the cell so that the cell signals binding to the target protein.

#### "One-Hybrid" Systems

In these systems, a chimera receptor, a hybrid of the target protein and an endogenous receptor, is used. The chimeric receptor has the ligand binding characteristics of the target protein and the signal transduction characteristics of the endogenous receptor. Thus, the normal signal transduction pathway of the endogenous receptor is subverted.

Preferably, the endogenous receptor is inactivated, or the conditions of the assay avoid activation of the endogenous receptor, to improve the signal-to-noise ratio.

See Fowlkes USP 5,789,184 for a yeast system.

Another type of "one-hybrid" system combines a peptide: DNA-binding domain fusion with an unfused target receptor that possesses an activation domain.

#### "Two-Hybrid" System

In a preferred embodiment, the cell-based assay is a two hybrid system. This term implies that the ligand is incorporated into a first hybrid protein, and the receptor into a second hybrid protein. The first hybrid also comprises component A of a signal generating system, and the second hybrid comprises component B of that system. Components A and B, by themselves, are insufficient to generate a signal. However, if the ligand binds the receptor, components A and B are brought into sufficiently close proximity so that they can cooperate to generate a signal.

Components A and B may naturally occur, or be substantially identical to moieties which naturally occur, as components of a single naturally occurring biomolecule,

or they may naturally occur, or be substantially identical to moieties which naturally occur, as separate naturally occurring biomolecules which interact in nature.

## 5 Two-Hybrid System: Transcription Factor Type

In a preferred "two-hybrid" embodiment, one member of a peptide ligand:receptor binding pair is expressed as a fusion to a DNA-binding domain (DBD) from a transcription factor (this fusion protein is called the "bait"), and the  
10 other is expressed as a fusion to a transactivation domain (TAD) (this fusion protein is called the "fish", the "prey", or the "catch"). The transactivation domain should be complementary to the DNA-binding domain, i.e., it should interact with the latter so as to activate transcription of  
15 a specially designed reporter gene that carries a binding site for the DNA-binding domain. Naturally, the two fusion proteins must likewise be complementary.

This complementarity may be achieved by use of the complementary and separable DNA-binding and transcriptional  
20 activator domains of a single transcriptional activator protein, or one may use complementary domains derived from different proteins. The domains may be identical to the native domains, or mutants thereof. The assay members may be fused directly to the DBD or TAD, or fused through an  
25 intermediated linker.

The target DNA operator may be the native operator sequence, or a mutant operator. Mutations in the operator may be coordinated with mutations in the DBD and the TAD. An example of a suitable transcription activation system is  
30 one comprising the DNA-binding domain from the bacterial repressor LexA and the activation domain from the yeast transcription factor Gal4, with the reporter gene operably linked to the LexA operator.

It is not necessary to employ the intact target  
35 receptor; just the ligand-binding moiety is sufficient.

The two fusion proteins may be expressed from the same or different vectors. Likewise, the activatable reporter

gene may be expressed from the same vector as either fusion protein (or both proteins), or from a third vector.

Potential DNA-binding domains include Gal4, LexA, and mutant domains substantially identical to the above.

5        Potential activation domains include E. coli B42, Gal4 activation domain II, and HSV VP16, and mutant domains substantially identical to the above.

10       Potential operators include the native operators for the desired activation domain, and mutant domains substantially identical to the native operator.

The fusion proteins may comprise nuclear localization signals.

15       The assay system will include a signal producing system, too. The first element of this system is a reporter gene operably linked to an operator responsive to the DBD and TAD of choice. The expression of this reporter gene will result, directly or indirectly, in a selectable or screenable phenotype (the signal). The signal producing system may include, besides the reporter gene, additional genetic or biochemical elements which cooperate in the production of the signal. Such an element could be, for example, a selective agent in the cell growth medium. There may be more than one signal producing system, and the system may include more than one reporter gene.

20       The sensitivity of the system may be adjusted by, e.g., use of competitive inhibitors of any step in the activation or signal production process, increasing or decreasing the number of operators, using a stronger or weaker DBD or TAD, etc.

30       When the signal is the death or survival of the cell in question, or proliferation or nonproliferation of the cell in question, the assay is said to be a selection. When the signal merely results in a detectable phenotype by which the signaling cell may be differentiated from the same cell in a nonsignaling state (either way being a living cell), the assay is a screen. However, the term "screening assay" may be used in a broader sense to include a selection. When the

35

narrower sense is intended, we will use the term "nonselective screen".

Various screening and selection systems are discussed in Ladner, USP 5,198,346.

5        Screening and selection may be for or against the peptide: target protein or compound:target protein interaction.

Preferred assay cells are microbial (bacterial, yeast, algal, protozoal), invertebrate, vertebrate (esp. 10        mammalian, particularly human). The best developed two-hybrid assays are yeast and mammalian systems.

Normally, two hybrid assays are used to determine whether a protein X and a protein Y interact, by virtue of their ability to reconstitute the interaction of the DBD and 15        the TAD. However, augmented two-hybrid assays have been used to detect interactions that depend on a third, non-protein ligand.

For more guidance on two-hybrid assays, see Brent and Finley, Jr., Ann. Rev. Genet., 31:663-704 (1997); Fremont- 20        Racine, et al., Nature Genetics, 277-281 (16 July 1997); Allen, et al., TIBS, 511-16 (Dec. 1995); LeCrenier, et al., BioEssays, 20:1-6 (1998); Xu, et al., Proc. Nat. Acad. sci. (USA), 94:12473-8 (Nov. 1992); Esotak, et al., Mol. Cell. Biol., 15:5820-9 (1995); Yang, et al., Nucleic Acids Res., 25        23:1152-6 (1995); Bendixen, et al., Nucleic Acids Res., 22:1778-9 (1994); Fuller, et al., BioTechniques, 25:85-92 (July 1998); Cohen, et al., PNAS (USA) 95:14272-7 (1998); Kolonin and Finley, Jr., PNAS (USA) 95:14266-71 (1998). See also Vasavada, et al., PNAS (USA), 88:10686-90 (1991) 30        (contingent replication assay), and Rehrauer, et al., J. Biol. Chem., 271:23865-73 91996) (LexA repressor cleavage assay).

#### Two-Hybrid Systems: reporter Enzyme type

35        In another embodiment, the components A and B reconstitute an enzyme which is not a transcription factor.

As in the last example, the effect of the reconstitution of the enzyme is a phenotypic change which may be a screenable change, a selectable change, or both.

5     In vivo Diagnostic Uses

Radio-labeled ABM may be administered to the human or animal subject. Administration is typically by injection, e.g., intravenous or arterial or other means of administration in a quantity sufficient to permit subsequent  
10     dynamic and/or static imaging using suitable radio-detecting devices. The dosage is the smallest amount capable of providing a diagnostically effective image, and may be determined by means conventional in the art, using known radio-imaging agents as a guide.

15     Typically, the imaging is carried out on the whole body of the subject, or on that portion of the body or organ relevant to the condition or disease under study. The amount of radio-labeled ABM accumulated at a given point in time in relevant target organs can then be quantified.

20     A particularly suitable radio-detecting device is a scintillation camera, such as a gamma camera. A scintillation camera is a stationary device that can be used to image distribution of radio-labeled ABM. The detection device in the camera senses the radioactive decay, the  
25     distribution of which can be recorded. Data produced by the imaging system can be digitized. The digitized information can be analyzed over time discontinuously or continuously. The digitized data can be processed to produce images, called frames, of the pattern of uptake of the radio-labeled  
30     ABM in the target organ at a discrete point in time. In most continuous (dynamic) studies, quantitative data is obtained by observing changes in distributions of radioactive decay in target organs over time. In other words, a time-activity analysis of the data will illustrate  
35     uptake through clearance of the radio-labeled binding protein by the target organs with time.

Various factors should be taken into consideration in selecting an appropriate radioisotope. The radioisotope



must be selected with a view to obtaining good quality resolution upon imaging, should be safe for diagnostic use in humans and animals, and should preferably have a short physical half-life so as to decrease the amount of radiation received by the body. The radioisotope used should preferably be pharmacologically inert, and, in the quantities administered, should not have any substantial physiological effect.

The ABM may be radio-labeled with different isotopes of iodine, for example  $^{123}\text{I}$ ,  $^{125}\text{I}$ , or  $^{131}\text{I}$  (see for example, U.S. Patent 4,609,725). The extent of radio-labeling must, however be monitored, since it will affect the calculations made based on the imaging results (i.e. a diiodinated ABM will result in twice the radiation count of a similar moniodinated ABM over the same time frame).

In applications to human subjects, it may be desirable to use radioisotopes other than  $^{125}\text{I}$  for labeling in order to decrease the total dosimetry exposure of the human body and to optimize the detectability of the labeled molecule (though this radioisotope can be used if circumstances require). Ready availability for clinical use is also a factor. Accordingly, for human applications, preferred radio-labels are for example,  $^{99\text{m}}\text{Tc}$ ,  $^{67}\text{Ga}$ ,  $^{68}\text{Ga}$ ,  $^{90}\text{Y}$ ,  $^{111}\text{In}$ ,  $^{113\text{m}}\text{In}$ ,  $^{123}\text{I}$ ,  $^{186}\text{Re}$ ,  $^{188}\text{Re}$  or  $^{211}\text{At}$ .

The radio-labeled ABM may be prepared by various methods. These include radio-halogenation by the chloramine - T method or the lactoperoxidase method and subsequent purification by HPLC (high pressure liquid chromatography), for example as described by J. Gutkowska et al in "Endocrinology and Metabolism Clinics of America: (1987) 16 (1):183. Other known methods of radio-labeling can be used, such as IODOBEADS™.

There are a number of different methods of delivering the radio-labeled ABM to the end-user. It may be administered by any means that enables the active agent to reach the agent's site of action in the body of a mammal. Because proteins are subject to being digested when administered orally, parenteral administration, i.e.,

intravenous, subcutaneous, intramuscular, would ordinarily be used to optimize absorption of an ABM, such as an antibody, which is a protein.

5

## **EXAMPLES**

### **Animal Models.**

Obesity and subsequent hyperinsulinemia and hyperglycemia were induced by feeding a group of 3 week old mice (50 C57BL/6 males) a high-fat diet (Bio-Serve, Frenchtown, NJ, #F1850 High Carbohydrate-High Fat). Another group of 3 week old mice (20 C57B1/6 males) were fed the normal control diet (PMI Nutrition International Inc., Brentwood, MO, Prolab RMH3000). The mice were placed onto the respective diets immediately following weaning. Animal weights were determined weekly. Fasting blood-glucose and plasma insulin measurements were determined after 2, 4, 8 and 16 weeks on the respective diets.

Normal weight, normal fasting blood glucose and normal fasting plasma insulin levels are defined as the respective mean values of the animals fed the control diet.

Two of the "most typical" animals were selected for each group (Control, hyperinsulinemic and Diabetic) at each time point ( 2,4, 8, and 16 weeks after commencement of diet) for sacrifice. The selected mice were sacrificed and muscle tissue obtained and immediately processed for RNA isolation.

### **Fasting Blood Glucose Levels.**

Blood glucose levels was measured from a drop of blood taken from the tip of the tail of fasted (8 hr) mice using a Lifescan Genuine One Touch glucometer. All measurements occurred between 2:00 pm and 5:00 pm.

### **Plasma insulin measurements.**

Blood was collected from the tail of fasted (8 hr) mice into a heparinized capillary tube and stored on ice. All collections occurred between 2:00 pm and 5:00 pm. Plasma

was separated from red blood cells by centrifugation for 10 minutes at 8000 x g and then stored at -20°C. Insulin concentrations were determined using the Rat Insulin ELISA kit and rat insulin standards (ALPCO) essentially as instructed by the manufacturer. Values were adjusted by a factor of 1.23 as determined by the manufacturer to correct for the species difference in cross-reactivity with the antibody.

#### **RNA isolation.**

Total RNA was isolated from muscle (skeletal muscle, specifically, gastrocnemius) using the RNA STAT-60 Total RNA/mRNA Isolation Reagent according to the manufacturer's instructions (Tel-Test, Friendswood, TX).

#### **Sample Quantification and Quality Assessment**

Total RNA was quantified and assessed for quality on a Bioanalyzer RNA 6000 Nano chip (Agilent). Each chip contained an interconnected set of gel-filled channels that allowed for molecular sieving of nucleic acids. Pin-electrodes in the chip were used to create electrokinetic forces capable of driving molecules through these micro-channels to perform electrophoretic separations. Ribosomal peaks were measured by fluorescence signal and displayed in an electropherogram. A successful total RNA sample featured 2 distinct ribosomal peaks (18S and 28S rRNA).

#### **Biotinylated cRNA Hybridization Target.**

Total RNA was prepared for use as a hybridization target as described in the manufacturer's instructions for CodeLink Expression Bioarrays(TM) (Amersham Biosciences). The CodeLink Expression Bioarrays utilize nucleic acid hybridization of a biotin-labeled complementary RNA(cRNA) target with DNA oligonucleotide probes attached to a gel matrix.

The biotin-labeled cRNA target is prepared by a linear amplification method. Poly (A) + RNA (within the total RNA

population) is primed for reverse transcription by a DNA oligonucleotide containing a T7 RNA polymerase promoter 5' to a (dT) 24 sequence. After second-strand cDNA synthesis, the cDNA serves as the template in an *in vitro* transcription (IVT) reaction to produce the target cRNA. The IVT is performed in the presence of biotinylated nucleotides to label the target cRNA. This procedure results in a 50-200 fold linear amplification of the input poly (A) + RNA.

#### 10 **Hybridization Probes.**

The oligonucleotide probes were provided by the Codelink Uniset Mouse I Bioarray (Amersham, product code 300013). Amine-terminated oligonucleotide probes are attached to a three-dimensional polyacrylamide gel matrix. There are 10,000 oligonucleotide probes, each specific to a well-characterized mouse gene. Each mouse gene is representative of a unique gene cluster from the fourth quarter 2001 Genbank Unigene build. There are also 500 control probes.

The sequences of the probes is proprietary to Amersham. However, for each probe, Amersham identifies the corresponding mouse gene by NCBI accession number, OGS, LocusLink, Unigene Cluster ID, and description (name). This information should be available from Amersham. In the case of the differentially expressed probes, this information is duplicated in master table 1. For the complete list, see [http://www4.amershambiosciences.com/aptrix/upp01077.nsf/Content/codelink\\_literature](http://www4.amershambiosciences.com/aptrix/upp01077.nsf/Content/codelink_literature)

Under "Gene Lists", select "Uniset Human I", and a gene list, in Excel format, can be downloaded.

#### **Hybridization**

Using the cRNA target, the hybridization reaction mixture is prepared and loaded until array chambers for bioarray processing as set forth in the manufacturer's instructions for CodeLink Gene Expression Bioarrays™

(Amersham Biosciences). Each sample is hybridized to an individual microarray. Hybridization is at 37°C. The hybridization buffer is prepared as set forth in the Motorola instructions. Hybridization to the microarray is detected with an avidinated fluorescent reagent, Streptavidin-Alexa Fluor<sup>®</sup> 647 (Amersham).

#### **Mouse Gene Expression Analysis**

Processed arrays were scanned using a GenePix 4000B Microarray Scanner (Axon Instruments, Inc.); array images were acquired using the Amersham CodeLink<sup>™</sup> Analysis Software (Release 2.2). The Amersham CodeLink<sup>™</sup> Analysis Software gives an integrated optical density (IOD) value for every spot; a unique background value for that spot is subtracted, resulting in "raw" data points. Individual chips are then normalized by the Amersham Codelink<sup>™</sup> software according to the median raw intensity for all 10,000 genes. A negative control threshold is also calculated according to the control probes. A significant difference in expression between samples was defined as a minimum of 2-fold change in expression values. Genes with expression values below the negative control threshold were eliminated from the analysis and then the expression data was analyzed to identify genes whose expression levels changed significantly with respect to:

Normal mice compared to hyperinsulinemic mice at 2, 4, 8 and 16 weeks on normal vs. high-fat diet.

Normal mice compared to hyperinsulinemic/hyperglycemic mice at 2, 4, 8 and 16 weeks on normal vs. high-fat diet.

Hyperinsulinemic compared to hyperinsulinemic/hyperglycemic mice at 2, 4, 8 and 16 weeks on high-fat diets.

**Database Searches** Nucleotide sequences and predicted amino acid sequences were compared to public domain databases using the Blast 2.0 program (National Center for Biotechnology Information, National Institutes of Health).

5 Nucleotide sequences were displayed using ABI prism Edit View 1.0.1 (PE Applied Biosystems, Foster City, CA).

Nucleotide database searches were conducted with the then current version of BLASTN 2.0.12, see Altschul, et al., "Gapped BLAST and PSI-BLAST: a new generation of protein  
10 database search programs", Nucleic Acids Res., 25:3389-3402 (1997). Searches employed the default parameters, unless otherwise stated.

For blastN searches, the default was the blastN matrix (1,-3), with gap penalties of 5 for existence and 2 for  
15 extension.

Protein database searches were conducted with the then-current version of BLAST X, see Altschul et al. (1997), supra. Searches employed the default parameters, unless  
20 otherwise stated. The scoring matrix was BLOSUM62, with gap costs of 11 for existence and 1 for extension. The standard low complexity filter was used.

"ref" indicates that NCBI's RefSeq is the source database. The identifier that follows is a RefSeq accession number, not a GenBank accession number. "RefSeq sequences  
25 are derived from GenBank and provide non-redundant curated data representing our current knowledge of known genes. Some records include additional sequence information that was never submitted to an archival database but is available in the literature. A small number of sequences are provided  
30 through collaboration; the underlying primary sequence data is available in GenBank, but may not be available in any one GenBank record. RefSeq sequences are not submitted primary sequences. RefSeq records are owned by NCBI and therefore can be updated as needed to maintain current annotation or  
35 to incorporate additional sequence information." See also <http://www.ncbi.nlm.nih.gov/LocusLink/refseq.html>

It will be appreciated by those in the art that the exact results of a database search will change from day to

day, as new sequences are added. Also, if you query with a longer version of the original sequence, the results will change. The results given here were obtained at one time and no guarantee is made that the exact same hits would be obtained in a search on the filing date. However, if an alignment between a particular query sequence and a particular database sequence is discussed, that alignment should not change (if the parameters and sequences remain unchanged).

#### **Northern Analysis.**

Northern analysis may be used to confirm the results. Favorable and unfavorable genes, identified as described above, or fragments thereof, will be used as probes in Northern hybridization analyses to confirm their differential expression. Total RNA isolated from Control, Hyperinsulinemic and Type-II Diabetic mice will be resolved by agarose gel electrophoresis through a 1% agarose, 1 % formaldehyde denaturing gel, transferred to positively charged nylon membrane, and hybridized to a probe labeled with [32P] dCTP that was generated from the aforementioned gene or fragment using the Random Primed DNA Labeling Kit (Roche, Palo Alto, CA) or to a probe labeled with digoxigenin (Roche Molecular Biochemicals, Indianapolis, IN) that was generated from the aforementioned gene or fragment using asymmetric PCR.

#### **Real-Time RNA Analysis.**

Real-time RNA analysis may also be used for confirmation. For "real-time" RNA analysis, RNA will be converted to cDNA and then probed with gene-specific primers made for each clone. "Real-time" incorporation of fluorescent dye will be measured to determine the amount of specific transcript present in each sample. Sample differences (control vs. hyperinsulinemic, hyperinsulinemic vs. diabetic, or control vs. diabetic) of 2-fold or greater (in either direction) will be considered differentially

expressed. Confirmation using several independent animals is desirable.

#### **In situ Hybridization**

5 Another form of confirmation may be provided by nonisotopic *in situ* hybridizations (NISH) on selected human (obtained by Tissue Informatics) and mouse tissues using cRNA probes generated from mouse genes found to be up- or down-regulated during the disease progression. Nonisotopic  
10 *in situ* hybridizations may also be performed on mouse tissues using cRNA probes generated from all "novel" cDNA's identified through PCR subtractive hybridizations. These cRNA's will hybridize to their corresponding messenger RNA's present in cells and will provide information regarding the  
15 particular cell types within a tissue that is expressing the particular gene as well as the relative level of gene expression. The cRNA probes may be generated by *in vitro* transcription of template cDNA by Sp6 or T7 RNA polymerase in the presence of digoxigenin-11-UTP (Roche Molecular  
20 Biochemicals, Indianapolis IN; Pardue, M.L. 1985. In: *In situ* hybridization, Nucleic acid hybridization, a practical approach: IRL Press, Oxford, 179-202).

#### **Transgenic Animals.**

25 Transgenic expression may be used to confirm the results. In one embodiment, a mouse is engineered to overexpress the favorable or unfavorable mouse gene in question. In another embodiment, a mouse is engineered to express the corresponding favorable or unfavorable human gene. In a  
30 third embodiment, a nonhuman animal other than a mouse, such as a rat, rabbit, goat, sheep or pig, is engineered to express the favorable or unfavorable mouse or human gene.

#### **Hyperquantitative Tissue Analysis**

35 In addition to gene expression analysis the muscle sections can also be analyzed using TissueInformatics, Inc.'s TissueAnalytics™ software. A single representative section may be cut from each muscle block, placed on a



slide, and stained with H&E. Digital images of each slide may be acquired using an research microscope and digital camera (Olympus E600 microscope and Sony DKC-ST5). These images were acquired at 20x magnification with a resolution of 0.64 mm/pixel. A hyperquantitative analysis may be performed on the resulting images: First a digital image analysis can identify and annotate structural objects in a tissue using machine vision. These objects, which are constituents of the tissue, can be annotated because they are visually identifiable and have a biological meaning. Subsequently a quantification of these structures regarding their geometric properties like area or stain intensities and their relationship to the field of view or per unit area in terms of a % coverage may be performed. Features or parameters for hyper-quantification are specific for each tissue, and may also include relations between features, measures of overall heterogeneity, including orientation, relative locations, and textures.

## **Correlation Analysis**

Mathematical statistics provides a rich set of additional tools to analyze time resolved data sets of hyper-quantitative and gene expression profiles for similarities, including rank correlation, the calculation of regression and correlations coefficients, and clustering. Continuous functions may also be fitted through the data points of individual gene and tissue feature data. Relation between gene expression and hyper-quantitative tissue data may be linear or non-linear, in synchronous or asynchronous arrangements.

A Spearman rank correlation analysis using was done on the 2 classes of measurements (Genes and Tissues Features) to help identify other significant genes. A small number of genes that did not meet the 2-Fold difference for significance were added to the list of genes based on their correlation with tissue features or consistent differential expression in multiple samples.



Citation of documents herein is not intended as an admission that any of the documents cited herein is pertinent prior art, or an admission that the cited documents is considered material to the patentability of any of the claims of the present application. All statements as to the date or representation as to the contents of these documents is based on the information available to the applicant and does not constitute any admission as to the correctness of the dates or contents of these documents.

The appended claims are to be treated as a non-limiting recitation of preferred embodiments.

In addition to those set forth elsewhere, the following references are hereby incorporated by reference, in their most recent editions as of the time of filing of this application: Kay, Phage Display of Peptides and Proteins: A Laboratory Manual; the John Wiley and Sons Current Protocols series, including Ausubel, Current Protocols in Molecular Biology; Coligan, Current Protocols in Protein Science; Coligan, Current Protocols in Immunology; Current Protocols in Human Genetics; Current Protocols in Cytometry; Current Protocols in Pharmacology; Current Protocols in Neuroscience; Current Protocols in Cell Biology; Current Protocols in Toxicology; Current Protocols in Field Analytical Chemistry; Current Protocols in Nucleic Acid Chemistry; and Current Protocols in Human Genetics; and the following Cold Spring Harbor Laboratory publications: Sambrook, Molecular Cloning: A Laboratory Manual; Harlow, Antibodies: A Laboratory Manual; Manipulating the Mouse Embryo: A Laboratory Manual; Methods in Yeast Genetics: A Cold Spring Harbor Laboratory Course Manual; Drosophila Protocols; Imaging Neurons: A Laboratory Manual; Early Development of *Xenopus laevis*: A Laboratory Manual; Using Antibodies: A Laboratory Manual; At the Bench: A Laboratory Navigator; Cells: A Laboratory Manual; Methods in Yeast Genetics: A Laboratory Course Manual; Discovering Neurons: The Experimental Basis of Neuroscience; Genome Analysis: A Laboratory Manual Series ; Laboratory DNA Science; Strategies for Protein Purification and Characterization: A

Laboratory Course Manual; Genetic Analysis of Pathogenic Bacteria: A Laboratory Manual; PCR Primer: A Laboratory Manual; Methods in Plant Molecular Biology: A Laboratory Course Manual ; Manipulating the Mouse Embryo: A Laboratory Manual; Molecular Probes of the Nervous System; Experiments with Fission Yeast: A Laboratory Course Manual; A Short Course in Bacterial Genetics: A Laboratory Manual and Handbook for Escherichia coli and Related Bacteria; DNA Science: A First Course in Recombinant DNA Technology; Methods in Yeast Genetics: A Laboratory Course Manual; Molecular Biology of Plants: A Laboratory Course Manual.

All references cited herein, including journal articles or abstracts, published, corresponding, prior or otherwise related U.S. or foreign patent applications, issued U.S. or foreign patents, or any other references, are entirely incorporated by reference herein, including all data, tables, figures, and text presented in the cited references. Additionally, the entire contents of the references cited within the references cited herein are also entirely incorporated by reference.

Reference to known method steps, conventional methods steps, known methods or conventional methods is not in any way an admission that any aspect, description or embodiment of the present invention is disclosed, taught or suggested in the relevant art.

The foregoing description of the specific embodiments will so fully reveal the general nature of the invention that others can, by applying knowledge within the skill of the art (including the contents of the references cited herein), readily modify and/or adapt for various applications such specific embodiments, without undue experimentation, without departing from the general concept of the present invention. Therefore, such adaptations and modifications are intended to be within the meaning and range of equivalents of the disclosed embodiments, based on the teaching and guidance presented herein. It is to be understood that the phraseology or terminology herein is for the purpose of description and not of limitation, such that the terminology

or phraseology of the present specification is to be interpreted by the skilled artisan in light of the teachings and guidance presented herein, in combination with the knowledge of one of ordinary skill in the art.

5       Any description of a class or range as being useful or preferred in the practice of the invention shall be deemed a description of any subclass (e.g., a disclosed class with one or more disclosed members omitted) or subrange contained therein, as well as a separate description of each  
10 individual member or value in said class or range.

      The description of preferred embodiments individually shall be deemed a description of any possible combination of such preferred embodiments, except for combinations which are impossible (e.g, mutually exclusive choices for an  
15 element of the invention) or which are expressly excluded by this specification.

      If an embodiment of this invention is disclosed in the prior art, the description of the invention shall be deemed to include the invention as herein disclosed with such  
20 embodiment excised.

## Introduction to Master Tables

The master tables reflect applicants' analysis of the gene chip data.

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For each probe corresponding to a differentially expressed mouse gene, Master Table 1 identifies

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Col. 1: The mouse gene (upper) and mouse protein (lower) database accession #s.

Col. 2: The corresponding mouse Unigene Cluster, as of the 4<sup>th</sup> Quarter 2001 build.

15

Col. 3: The behavior (differential expression) observed for the mouse gene. This column identifies the gene as favorable(F) or unfavorable (U) on the basis of its differential behavior. There are three possible comparisons, HI-D, C-HI, and C-D, where C=control (normal), HI=hyperinsulinemic, and D=diabetic.

20

If the level of the gene in the former state is at least two-fold that in the latter state, it is considered unfavorable. If the level of the gene in the former state is not more than half (i.e., not more than negative two fold) that in the latter state, it is considered favorable.

25

Col. 4: A related human protein, identified by its database accession number. Usually, several such proteins are identified relative to each mouse gene. These proteins have been identified by BLAST searches, as explained in cols. 6-8.

30

Col. 5: The name of the related human protein.

35

Col. 6: The score (in bits) for the alignment performed by the BLAST program.

Col. 7: The E-value for the alignment performed by the BLAST program. It is worth noting that Unigene considers a Blastx E Value of less than  $1e-6$  to be a "match" to the reference sequence of a cluster.

5

Master Table 1 is divided into three subtables on the basis of the Behavior" in col. 3. If a gene has at least one favorable behavior, and no unfavorable ones, it is put into Subtable 1A. In the opposite case, it is put into Subtable 1B. If its behavior is mixed, i.e., at least one favorable and at least one unfavorable, it is put into Subtable 1C.

10

The corresponding human gene clusters are also of interest. These may be obtained in a number of ways. First, one may search on Unigene

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(<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=unigene>) for the identified human protein. Review the "hits" (each of which is a Unigene record) for those prefixed by "Hs."

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Secondly, one may access the Unigene record for the mouse gene cluster (which is given in Master Table 1), and then click on "Homologene". This will bring up a new page which includes the section "Possible Homologous Genes". One of the entries should be a Homo sapiens gene (considered by Unigene to be the most related human gene); click on its Unigene record link.

25

Additional information of interest may be accessed by searching with the mouse gene accession # in the Mouse Gene Informatics database, at <http://www.informatics.jax.org/>.

**Master Table 1**  
**Subtable 1A: Favorable Genes and Proteins**

| Mouse Gene Protein       | Unigene  | Behavior          | Human Proteins | Human Protein Name                                                                                                                                             | Score (bits) | E-value  |
|--------------------------|----------|-------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|
| X82786<br>CAA58026.1     | Mm.4078  | F:(IR-D)<br>-3.33 | NP_002408.2    | antigen identified by monoclonal antibody Ki-67; Proliferation-related Ki-67 antigen                                                                           | 1711         | 0        |
|                          |          |                   | P46013         | KI67 HUMAN Antigen KI-67                                                                                                                                       | 1711         | 0        |
|                          |          |                   | A48666         | cell proliferation antigen Ki-67, long form                                                                                                                    | 1711         | 0        |
|                          |          |                   | CAA46519.1     | antigen of the monoclonal antibody Ki-67                                                                                                                       | 1711         | 0        |
|                          |          |                   | CAA46520.1     | antigen of the monoclonal antibody Ki-67                                                                                                                       | 1315         | 0        |
|                          |          |                   | B48666         | cell proliferation antigen Ki-67, short form                                                                                                                   | 1276         | 0        |
| NM_013788<br>NP_038816.1 | Mm.90135 | F:(IR-D)<br>-2.74 | BAB86352.1     | GSK-3beta binding protein FRAT1                                                                                                                                | 205          | 8.00E-54 |
|                          |          |                   | AAH34476.1     | frequently rearranged in advanced T-cell lymphomas                                                                                                             | 204          | 1.00E-53 |
|                          |          |                   | NP_005470.1    | frequently rearranged in advanced T-cell lymphomas                                                                                                             | 204          | 2.00E-53 |
|                          |          |                   | Q92837         | FRT1_HUMAN Proto-oncogene FRAT1 (Frequently rearranged in advanced T-cell lymphomas)                                                                           | 204          | 2.00E-53 |
|                          |          |                   | AAB97096.2     | proto-oncogene                                                                                                                                                 | 204          | 2.00E-53 |
| NM_019641<br>NP_062615.1 | Mm.28479 | F:(IR-D)<br>-2.54 | NP_005554.1    | stathmin 1; metablastin; prosolin; oncoprotein 18; phosphoprotein 19; stathmin; leukemia-associated phosphoprotein p18                                         | 286          | 8.00E-78 |
|                          |          |                   | P16949         | STN1_HUMAN Stathmin (Phosphoprotein p19) (pp19) (Oncoprotein 18) (Op18) (Leukemia-associated phosphoprotein p18) (pp17) (Proslin) (Metablastin) (Pr22 protein) | 286          | 8.00E-78 |
|                          |          |                   | A40936         | stathmin                                                                                                                                                       | 286          | 8.00E-78 |
|                          |          |                   | CAA77660.1     | Pr22 protein                                                                                                                                                   | 286          | 8.00E-78 |
|                          |          |                   | CAA37391.1     | stathmin                                                                                                                                                       | 286          | 8.00E-78 |
|                          |          |                   | AAA59971.1     | oncoprotein 18                                                                                                                                                 | 286          | 8.00E-78 |
|                          |          |                   | AAA59980.1     | protein p18                                                                                                                                                    | 286          | 8.00E-78 |
|                          |          |                   | CAA64398.1     | Pr22                                                                                                                                                           | 286          | 8.00E-78 |
|                          |          |                   | CAC16020.1     | dJ12513.1 (leukemia-associated phosphoprotein p18 (stathmin))                                                                                                  | 286          | 8.00E-78 |
|                          |          |                   | AAH14353.1     | AAH14353 Similar to stathmin 1/oncoprotein 18                                                                                                                  | 285          | 2.00E-77 |
|                          |          |                   | Q9H169         | STN4_HUMAN Stathmin 4 (Stathmin-like protein B3) (RB3)                                                                                                         | 194          | 4.00E-50 |
|                          |          |                   | CAC22254.1     | RB3 protein                                                                                                                                                    | 194          | 4.00E-50 |



|             |          |          |             |                                                                                                                                                              |      |          |
|-------------|----------|----------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |          |          | CAB66503.1  | hypothetical protein                                                                                                                                         | 194  | 4.00E-50 |
|             |          |          | NP_110422.2 | stathmin-like-protein RB3                                                                                                                                    | 194  | 4.00E-50 |
|             |          |          | AAH11520.1  | AAH11520 Similar to stathmin-like-protein RB3                                                                                                                | 194  | 4.00E-50 |
| NM_011623   | Mm.4237  | F:(IR-D) | NP_001058.2 | DNA topoisomerase II, alpha isozyme; topoisomerase (DNA) II alpha (170kD); DNA topoisomerase II, 170 kD                                                      | 2463 | 0        |
| NP_035753.1 |          | -2.33    |             |                                                                                                                                                              |      |          |
|             |          |          | P11388      | TP2A_HUMAN DNA topoisomerase II, alpha isozyme                                                                                                               | 2463 | 0        |
|             |          |          | AAC77388.1  | topoisomerase II alpha                                                                                                                                       | 2463 | 0        |
|             |          |          | AAA61209.1  | DNA topoisomerase II (EC 5.99.1.3)                                                                                                                           | 2462 | 0        |
|             |          |          | CAA09762.1  | DNA topoisomerase (ATP-hydrolysing); topoisomerase II alpha                                                                                                  | 2454 | 0        |
|             |          |          | A40493      | DNA topoisomerase (ATP-hydrolyzing) (EC 5.99.1.3) alpha                                                                                                      | 2441 | 0        |
|             |          |          | Q02880      | TP2B_HUMAN DNA topoisomerase II, beta isozyme                                                                                                                | 1923 | 0        |
|             |          |          | A39242      | DNA topoisomerase (ATP-hydrolyzing) (EC 5.99.1.3) beta, splice form 2                                                                                        | 1923 | 0        |
|             |          |          | NP_001059.2 | DNA topoisomerase II, beta isozyme; topo II beta; DNA topoisomerase II, 180 kD; topoisomerase (DNA) II beta (180kD)                                          | 1923 | 0        |
|             |          |          | CAA48197.1  | DNA topoisomerase II                                                                                                                                         | 1923 | 0        |
|             |          |          | AAC77432.1  | DNA topoisomerase II beta                                                                                                                                    | 1918 | 0        |
|             |          |          | AAA61210.1  | topoisomerase II                                                                                                                                             | 1494 | 0        |
| AK007688    | Mm.41925 | F:(IR-D) | NP_076947.1 | hypothetical protein MGC2601                                                                                                                                 | 457  | e-128    |
| AAH37181.1  |          | -2.27    |             |                                                                                                                                                              |      |          |
|             |          |          | CAB56188.1  | c380A1.2.1 (novel protein (isoform 1))                                                                                                                       | 457  | e-128    |
|             |          |          | AAH00662.1  | Unknown (protein for MGC:2601)                                                                                                                               | 457  | e-128    |
|             |          |          | AAK61247.1  | AE006464 15 unknown                                                                                                                                          | 457  | e-128    |
|             |          |          | CAB56189.1  | c380A1.2.2 (novel protein (isoform 2))                                                                                                                       | 300  | 3E-81    |
| NM_011593   | Mm.8245  | F:(IR-D) | CAA26443.1  | EPA glycoprotein                                                                                                                                             | 270  | 1.00E-72 |
| NP_035723.1 |          | -2.18    |             |                                                                                                                                                              |      |          |
|             |          |          | NP_003245.1 | tissue inhibitor of metalloproteinase 1 precursor; Erythroid-potentiating activity (tissue inhibitor of metalloproteinases); erythroid potentiating activity | 270  | 1.00E-72 |
|             |          |          | P01033      | TIM1_HUMAN Metalloproteinase inhibitor 1 precursor (TIMP-1) (Erythroid potentiating activity) (EPA) (Tissue inhibitor of metalloproteinases) (Fibroblast     | 270  | 1.00E-72 |

|                          |          |                   |  |             |                                                                                                           |     |          |
|--------------------------|----------|-------------------|--|-------------|-----------------------------------------------------------------------------------------------------------|-----|----------|
|                          |          |                   |  |             | collagenase inhibitor) (Collagenase inhibitor)                                                            |     |          |
|                          |          |                   |  | ZYHUEP      | metalloproteinase tissue inhibitor 1 precursor [validated]                                                | 270 | 1.00E-72 |
|                          |          |                   |  | CAA26902.1  | precursor                                                                                                 | 270 | 1.00E-72 |
|                          |          |                   |  | AAA52436.1  | prefibroblast collagenase inhibitor                                                                       | 270 | 1.00E-72 |
|                          |          |                   |  | AAA63234.1  | collagenase inhibitor                                                                                     | 270 | 1.00E-72 |
|                          |          |                   |  | AAD14009.1  | S68252 1 metalloproteinase inhibitor                                                                      | 270 | 1.00E-72 |
|                          |          |                   |  | AAH00866.1  | AAH00866 tissue inhibitor of metalloproteinase 1 (erythroid potentiating activity, collagenase inhibitor) | 270 | 1.00E-72 |
|                          |          |                   |  | 1107278A    | erythroid potentiating activity                                                                           | 270 | 1.00E-72 |
|                          |          |                   |  | 1308125A    | metalloproteinase inhibitor                                                                               | 270 | 1.00E-72 |
|                          |          |                   |  | 1UEA        | B Chain B, Mmp-3TIMP-1 Complex                                                                            | 264 | 8.00E-71 |
|                          |          |                   |  | 1UEA        | D Chain D, Mmp-3TIMP-1 Complex                                                                            | 264 | 8.00E-71 |
|                          |          |                   |  | BAA01913.1  | tissue inhibitor of metalloproteinases                                                                    | 236 | 1.00E-62 |
|                          |          |                   |  | AAH07097.1  | AAH07097 tissue inhibitor of metalloproteinase 1 (erythroid potentiating activity, collagenase inhibitor) | 221 | 6.00E-58 |
| NM_016785<br>NP_058065.1 | Mm.10169 | F:(IR-D)<br>-2.18 |  | NP_000358.1 | thiopurine S-methyltransferase                                                                            | 376 | e-104    |
|                          |          |                   |  | P51580      | TPMT HUMAN Thiopurine S-methyltransferase (Thiopurine methyltransferase)                                  | 376 | e-104    |
|                          |          |                   |  | I57946      | thiopurine methyltransferase                                                                              | 376 | e-104    |
|                          |          |                   |  | AAB27277.1  | thiopurine methyltransferase; TPMT                                                                        | 376 | e-104    |
|                          |          |                   |  | AAC50130.1  | thiopurine methyltransferase                                                                              | 376 | e-104    |
|                          |          |                   |  | AAC50368.1  | thiopurine methyltransferase                                                                              | 376 | e-104    |
|                          |          |                   |  | AAC51865.1  | thiopurine S-methyltransferase                                                                            | 376 | e-104    |
|                          |          |                   |  | BAA97037.1  | thiopurine S-methyltransferase                                                                            | 376 | e-104    |
|                          |          |                   |  | AAH09596.1  | AAH09596 thiopurine S-methyltransferase                                                                   | 376 | e-104    |
|                          |          |                   |  | AAB71630.1  | thiopurine methyltransferase                                                                              | 375 | e-104    |
|                          |          |                   |  | AAB71626.1  | thiopurine methyltransferase                                                                              | 375 | e-104    |
|                          |          |                   |  | AAB80746.1  | thiopurine S-methyltransferase                                                                            | 374 | e-103    |
|                          |          |                   |  | AAB71629.1  | thiopurine methyltransferase                                                                              | 374 | e-103    |
|                          |          |                   |  | AAB71627.1  | thiopurine methyltransferase                                                                              | 373 | e-103    |
|                          |          |                   |  | AAH05339.1  | AAH05339 thiopurine S-methyltransferase                                                                   | 372 | e-103    |
|                          |          |                   |  | AAB71625.1  | thiopurine methyltransferase                                                                              | 371 | e-103    |

|             |          |                   |             |                                                                                                                                                           |                                         |              |
|-------------|----------|-------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------|
|             |          |                   |             | AAB80747.1                                                                                                                                                | thiopurine S-methyltransferase          | 371 e-130    |
|             |          |                   |             | AAC50129.1                                                                                                                                                | thiopurine methyltransferase            | 265 9.00E-84 |
|             |          |                   |             | XP_031946.2                                                                                                                                               | similar to thiopurine methyltransferase | 265 6.00E-83 |
| U08020      | Mm.22621 | F:(IR-D)<br>-2.16 | P02452      | CA11_HUMAN                                                                                                                                                | Collagen alpha 1(I) chain precursor     | 486 e-136    |
| AAA88912.1  |          |                   | AAB94054.2  | pro alpha 1(I) collagen                                                                                                                                   |                                         | 486 e-136    |
|             |          |                   | NP_000079.1 | alpha 1 type I collagen preproprotein; Collagen I, alpha-1 polypeptide; osteogenesis imperfecta type IV; collagen of skin, tendon and bone, alpha-1 chain |                                         | 484 e-136    |
|             |          |                   | CAA98968.1  | prepro-alpha 1(I) collagen                                                                                                                                |                                         | 484 e-136    |
|             |          |                   | CGHU1S      | collagen alpha 1(I) chain precursor                                                                                                                       |                                         | 483 e-136    |
|             |          |                   | AAA51995.1  | alpha 1 (I) chain propeptide                                                                                                                              |                                         | 482 e-135    |
|             |          |                   | AAH36531.1  | Unknown (protein for MGC:33668)                                                                                                                           |                                         | 480 e-135    |
|             |          |                   | AAB27856.1  | type I collagen pro alpha 1(I) chain propeptide                                                                                                           |                                         | 469 e-131    |
|             |          |                   | CAA29605.1  | C-terminal propeptide domain                                                                                                                              |                                         | 435 e-121    |
|             |          |                   | CAA29604.1  | pro-alpha 1 (II) collagen (313 AA; AA 975-271c)                                                                                                           |                                         | 372 e-102    |
|             |          |                   | NP_001835.2 | alpha 1 type II collagen isoform 1; collagen II, alpha-1 polypeptide; cartilage collagen; chondrocalcin, included; COL11A3, formerly                      |                                         | 372 e-102    |
|             |          |                   | AAC41772.1  | alpha-1 type II collagen                                                                                                                                  |                                         | 372 e-102    |
| NM_023043   | Mm.18075 | F:(IR-D)<br>-2.14 | NP_036541.1 | prion gene complex, downstream                                                                                                                            |                                         | 283 1.00E-75 |
| NP_075530.1 |          |                   |             |                                                                                                                                                           |                                         |              |
|             |          |                   | Q9UKY0      | PRND HUMAN Prion-like protein doppel precursor (PrPLP) (Prion protein 2)                                                                                  |                                         | 283 1.00E-75 |
|             |          |                   | AAF02424.1  | AF106918 1 prion-like protein                                                                                                                             |                                         | 283 1.00E-75 |
|             |          |                   | CAB75502.1  | dJ1068H6.4 (prion protein like protein doppel)                                                                                                            |                                         | 282 2.00E-75 |
|             |          |                   | AAG43449.1  | prion-like protein                                                                                                                                        |                                         | 281 3.00E-75 |
|             |          |                   | AAG43448.1  | AF187843 1 doppel protein                                                                                                                                 |                                         | 246 2.00E-64 |
| NM_009464   | Mm.6254  | F:(IR-D)<br>-2.07 | NP_003347.1 | uncoupling protein 3, isoform UCP3L                                                                                                                       |                                         | 531 e-151    |
| NP_033490.1 |          |                   |             |                                                                                                                                                           |                                         |              |
|             |          |                   | P55916      | UCP3_HUMAN Mitochondrial uncoupling protein 3 (UCP 3)                                                                                                     |                                         | 531 e-151    |
|             |          |                   | JC5522      | uncoupling protein UCP3, mitochondrial                                                                                                                    |                                         | 531 e-151    |

|             |          |          |  |             |                                                                                                                                           |  |     |       |
|-------------|----------|----------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-------|
|             |          |          |  | AAC51367.1  | UCP3                                                                                                                                      |  | 531 | e-151 |
|             |          |          |  | AAC51369.1  | uncoupling protein 3                                                                                                                      |  | 531 | e-151 |
|             |          |          |  | AAC51767.1  | uncoupling protein-3                                                                                                                      |  | 531 | e-151 |
|             |          |          |  | AAG02284.1  | AF050113_1 uncoupling protein-3                                                                                                           |  | 531 | e-151 |
|             |          |          |  | AAC18822.1  | uncoupling protein 3                                                                                                                      |  | 525 | e-149 |
|             |          |          |  | AAC51785.1  | uncoupling protein 3                                                                                                                      |  | 510 | e-144 |
|             |          |          |  | NP_073714.1 | uncoupling protein 3, isoform UCP3S                                                                                                       |  | 464 | e-131 |
|             |          |          |  | AAC51356.1  | UCP3S                                                                                                                                     |  | 464 | e-131 |
|             |          |          |  | AAB48411.1  | uncoupling protein-2                                                                                                                      |  | 457 | e-129 |
|             |          |          |  | NP_003346.2 | uncoupling protein 2                                                                                                                      |  | 456 | e-128 |
|             |          |          |  | P55851      | UCP2_HUMAN Mitochondrial uncoupling protein 2 (UCP 2) (UCPH)                                                                              |  | 456 | e-128 |
|             |          |          |  | AAC51336.1  | UCP2                                                                                                                                      |  | 456 | e-128 |
|             |          |          |  | AAC39690.1  | uncoupling protein 2                                                                                                                      |  | 456 | e-128 |
|             |          |          |  | AAD21151.1  | uncoupling protein-2                                                                                                                      |  | 456 | e-128 |
|             |          |          |  | AAH11737.1  | AAH11737 uncoupling protein 2 (mitochondrial, proton carrier)                                                                             |  | 456 | e-128 |
|             |          |          |  | AAB53091.1  | uncoupling protein homolog                                                                                                                |  | 456 | e-128 |
|             |          |          |  | CAA11402.1  | uncoupling protein 2                                                                                                                      |  | 456 | e-128 |
|             |          |          |  | NP_068605.1 | uncoupling protein 1; mitochondrial brown fat uncoupling protein                                                                          |  | 345 | 7E-95 |
|             |          |          |  | G01858      | uncoupling protein 1, mitochondrial                                                                                                       |  | 345 | 7E-95 |
|             |          |          |  | AAA85271.1  | uncoupling protein                                                                                                                        |  | 345 | 7E-95 |
|             |          |          |  | P25874      | UCP1_HUMAN Mitochondrial brown fat uncoupling protein 1 (UCP 1) (Thermogenin)                                                             |  | 342 | 6E-94 |
|             |          |          |  | CAA36214.1  | uncoupling protein                                                                                                                        |  | 342 | 6E-94 |
|             |          |          |  | AAH08392.1  | AAH08392 Similar to uncoupling protein 3 (mitochondrial, proton carrier)                                                                  |  | 214 | 2E-55 |
| AK014626    | Mm.10557 | F:(IR-D) |  | CAC07336.1  | dJ137F1.2 (novel member of the potassium channel subfamily K)                                                                             |  | 309 | 9E-84 |
| XP_138942.1 | 1        | -2.06    |  |             |                                                                                                                                           |  |     |       |
|             |          |          |  | NP_115491.1 | potassium channel, subfamily K, member 16; pancreatic 2P domain potassium channel TALK-1                                                  |  | 285 | 2E-76 |
|             |          |          |  | Q96T55      | CIWG_HUMAN Potassium channel subfamily K member 16 (TWIK-related alkaline pH activated K+ channel 1) (2P domain potassium channel Talk-1) |  | 285 | 2E-76 |

|                          |          |                   |                           |                                                                                                              |                           |
|--------------------------|----------|-------------------|---------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------|
| NM_010514<br>NP_034644.1 | Mm.3862  | F:(IR-D)<br>-2.06 | AAK49532.1<br>NP_000603.1 | AF358909 1 2P domain potassium channel Talk-1<br>insulin-like growth factor 2 (somatomedin A); somatomedin A | 285 2E-76<br>255 5.00E-67 |
|                          |          |                   | P01344                    | IGF2_HUMAN Insulin-like growth factor II precursor (IGF-II) (Somatomedin A)                                  | 255 5.00E-67              |
|                          |          |                   | IGHU2                     | insulin-like growth factor II precursor [validated]                                                          | 255 5.00E-67              |
|                          |          |                   | CAA25426.1                | IGF-II precursor                                                                                             | 255 5.00E-67              |
|                          |          |                   | CAA29516.1                | precursor polypeptide (AA -24 to 156)                                                                        | 255 5.00E-67              |
|                          |          |                   | AAA52442.1                | preproinsulin-like growth factor II, domains A-E                                                             | 255 5.00E-67              |
|                          |          |                   | AAA52535.1                | insulin-like growth factor                                                                                   | 255 5.00E-67              |
|                          |          |                   | AAA52545.1                | insulin-like growth factor II precursor                                                                      | 255 5.00E-67              |
|                          |          |                   | AAA60088.1                | insulin-like growth factor II                                                                                | 255 5.00E-67              |
|                          |          |                   | AAB34155.1                | insulin-like growth factor II; IGF-II                                                                        | 255 5.00E-67              |
|                          |          |                   | AAG17220.1                | AF217977 1 unknown                                                                                           | 255 5.00E-67              |
|                          |          |                   | AAH00531.1                | AAH00531 insulin-like growth factor 2 (somatomedin A)                                                        | 255 5.00E-67              |
|                          |          |                   | AAM51825.1                | AF517226 1 insulin-like growth factor 2 (somatomedin A)                                                      | 255 5.00E-67              |
|                          |          |                   | I009249A                  | insulin-like growth factor II precursor                                                                      | 255 5.00E-67              |
|                          |          |                   | I203258B                  | insulin-like growth factor II                                                                                | 255 5.00E-67              |
|                          |          |                   | AAA52544.1                | insulin-like growth factor II precursor                                                                      | 254 1.00E-66              |
|                          |          |                   | I67610                    | insulin-like growth factor II, domains A-E                                                                   | 250 2.00E-65              |
|                          |          |                   | AAA52443.1                | preproinsulin-like growth factor II, domains A-E                                                             | 250 2.00E-65              |
|                          |          |                   | S02423                    | insulin-like growth factor II precursor, splice form II                                                      | 249 3.00E-65              |
|                          |          |                   | CAA27249.1                | put. IGF-II                                                                                                  | 249 3.00E-65              |
|                          |          |                   | CAA29517.1                | precursor polypeptide (AA -24 to 140)                                                                        | 223 2.00E-57              |
| NM_012000<br>NP_036130.1 | Mm.21578 | F:(IR-D)<br>-2.09 | AAH07725.1                | AAH07725 ceroid-lipofuscinosis, neuronal 8 (epilepsy, progressive with mental retardation)                   | 448 e-125                 |
|                          |          |                   | NP_061764.1               | ceroid-lipofuscinosis, neuronal 8 (epilepsy, progressive with mental retardation)                            | 446 e-125                 |
|                          |          |                   | Q9UBY8                    | CLN8_HUMAN CLN8 protein                                                                                      | 446 e-125                 |
|                          |          |                   | AAF13115.1                | AF123757 1 putative transmembrane protein                                                                    | 446 e-125                 |
|                          |          |                   | AAF13116.1                | AF123758 1 putative transmembrane protein                                                                    | 446 e-125                 |
|                          |          |                   | AAF13117.1                | AF123759 1 putative transmembrane protein                                                                    | 446 e-125                 |

|             |          |                   |  |             |                                                                                                                                                             |              |
|-------------|----------|-------------------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|             |          |                   |  | AAF13118.1  | AF123760 1 putative transmembrane protein                                                                                                                   | 446 e-125    |
|             |          |                   |  | AAF13119.1  | AF123761 1 putative transmembrane protein                                                                                                                   | 446 e-125    |
| NM_025285   | Mm.29580 | F:(C-IR)<br>-4.72 |  | XP_170521.1 | similar to data source:MGD, source key:MGI:98241,<br>evidence:ISS~putative~superiorcervical ganglia, neural specific 10                                     | 345 2.00E-94 |
| NP_079561.1 |          |                   |  |             |                                                                                                                                                             |              |
|             |          |                   |  | AAH06302.1  | AAH06302 Similar to superiorcervical ganglia, neural specific 10                                                                                            | 345 2.00E-94 |
|             |          |                   |  | NP_008960.1 | superiorcervical ganglia, neural specific 10; neuronal growth-associated protein<br>(silencer element); superior cervical ganglia, neural specific 10       | 342 1.00E-93 |
|             |          |                   |  | AAB36428.1  | SCG10                                                                                                                                                       | 342 1.00E-93 |
|             |          |                   |  | Q93045      | STN2_HUMAN Stathmin 2 (SCG10 protein) (Superior cervical ganglion-10 protein)                                                                               | 342 1.00E-93 |
|             |          |                   |  | BAA23326.1  | silencer element                                                                                                                                            | 342 1.00E-93 |
|             |          |                   |  | NP_056978.2 | SCG10-like-protein                                                                                                                                          | 249 1.00E-65 |
|             |          |                   |  | Q9NZ72      | STN3_HUMAN Stathmin 3 (SCG10-like protein)                                                                                                                  | 249 1.00E-65 |
|             |          |                   |  | AAF35245.1  | SCG10 like-protein                                                                                                                                          | 249 1.00E-65 |
|             |          |                   |  | CAC16222.1  | bK3184A7.2 (SCG10-like protein (SCLIP) (ortholog of rabbit neuroplasticin-2<br>(NPC2)))                                                                     | 249 1.00E-65 |
|             |          |                   |  | AAH09381.1  | AAH09381 Unknown (protein for MGC:16668)                                                                                                                    | 249 1.00E-65 |
|             |          |                   |  | AAD12730.1  | SCG10-like-protein                                                                                                                                          | 248 2.00E-65 |
|             |          |                   |  | BAC11252.1  | unnamed protein product                                                                                                                                     | 245 2.00E-65 |
|             |          |                   |  | Q9H169      | STN4_HUMAN Stathmin 4 (Stathmin-like protein B3) (RB3)                                                                                                      | 217 5.00E-56 |
|             |          |                   |  | CAC22254.1  | RB3 protein                                                                                                                                                 | 217 5.00E-56 |
|             |          |                   |  | CAB66503.1  | hypothetical protein                                                                                                                                        | 217 5.00E-56 |
|             |          |                   |  | NP_110422.2 | stathmin-like-protein RB3                                                                                                                                   | 206 7.00E-53 |
|             |          |                   |  | AAH11520.1  | AAH11520 Similar to stathmin-like-protein RB3                                                                                                               | 206 7.00E-53 |
| NM_008687   | Mm.4025  | F:(C-IR)<br>-2.69 |  | AAH01283.1  | Similar to nuclear factor I/B                                                                                                                               | 808 0        |
| NP_032713.1 |          |                   |  |             |                                                                                                                                                             |              |
|             |          |                   |  | NP_005587.1 | nuclear factor I/B                                                                                                                                          | 807 0        |
|             |          |                   |  | O00712      | NFIB_HUMAN Nuclear factor 1 B-type (Nuclear factor 1/B) (NF1-B) (NF1-B) (NF-<br>I/B) (CCAAT-box binding transcription factor) (CTF) (TGGCA-binding protein) | 807 0        |
|             |          |                   |  | AAB41899.1  | nuclear factor I-B2                                                                                                                                         | 807 0        |

|             |          |          |       |             |                                                                                                                                                        |           |           |
|-------------|----------|----------|-------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|
|             |          |          |       | AAA93125.1  | nuclear factor 1 B-type                                                                                                                                |           | 507 e-143 |
|             |          |          |       | NP_005588.1 | nuclear factor 1/C (CCAAT-binding transcription factor)                                                                                                |           | 499 e-140 |
|             |          |          |       | CAA63440.1  | NF1/CAAT-binding transcription factor 5 (CTF5)                                                                                                         |           | 499 e-140 |
|             |          |          |       | AAH12120.1  | nuclear factor 1/C (CCAAT-binding transcription factor)                                                                                                |           | 499 e-140 |
|             |          |          |       | P08651      | NFIC_HUMAN Nuclear factor 1 C-type (Nuclear factor 1/C) (NF1-C) (NF1-C) (NF1-C) (CCAAT-box binding transcription factor) (CTF) (TGGCA-binding protein) | 487 e-137 |           |
|             |          |          |       | B33416      | nuclear factor 1                                                                                                                                       | 484 e-136 |           |
|             |          |          |       | BAA92677.1  | KIAA1439 protein                                                                                                                                       | 484 e-136 |           |
|             |          |          |       | Q12857      | NF1A_HUMAN Nuclear factor 1 A-type (Nuclear factor 1/A) (NF1-A) (NF1-A) (NF1-A) (CCAAT-box binding transcription factor) (CTF) (TGGCA-binding protein) | 483 e-136 |           |
|             |          |          |       | XP_046827.7 | similar to transcription factor NF1                                                                                                                    | 483 e-136 |           |
|             |          |          |       | AAH22264.1  | Nuclear Factor 1A                                                                                                                                      | 483 e-136 |           |
| AK013022    | Mm.28026 | F:(C-IR) | -2.41 | Q9NZJ3      | SELT_HUMAN Selenoprotein T                                                                                                                             | 334 2E-91 |           |
|             |          |          |       | NP_057359.1 | selenoprotein T                                                                                                                                        | 326 4E-89 |           |
|             |          |          |       | AAF13696.1  | selenoprotein T                                                                                                                                        | 326 4E-89 |           |
|             |          |          |       | XP_088553.  | similar to Selenoprotein T                                                                                                                             | 317 2E-86 |           |
|             |          |          |       | AAD20063.1  | Unknown                                                                                                                                                | 284 2E-76 |           |
|             |          |          |       | AAH36738.1  | Unknown (protein for MGC:45090)                                                                                                                        | 284 2E-76 |           |
| NM_019643   | Mm.18637 | F:(C-IR) | -2.4  | NP_067061.1 | TERA protein                                                                                                                                           | 402 e-111 |           |
| NP_062617.1 |          |          |       |             |                                                                                                                                                        |           |           |
|             |          |          |       | T46918      | hypothetical protein DKFZp762L137.1                                                                                                                    | 402 e-111 |           |
|             |          |          |       | CAB75656.1  | hypothetical protein                                                                                                                                   | 402 e-111 |           |
|             |          |          |       | AAF87322.1  | AF212220 1 TERA                                                                                                                                        | 402 e-111 |           |
|             |          |          |       | BAB15592.1  | unnamed protein product                                                                                                                                | 402 e-111 |           |
|             |          |          |       | AAH00024.1  | AAH00024 TERA protein                                                                                                                                  | 402 e-111 |           |
|             |          |          |       |             |                                                                                                                                                        |           |           |
| NM_022314   | Mm.17306 | F:(C-IR) | -2.32 | P06753      | TPM3_HUMAN Tropomyosin alpha 3 chain (Tropomyosin 3) (Tropomyosin gamma)                                                                               | 365 e-101 |           |
| NP_071709.1 |          |          |       |             |                                                                                                                                                        |           |           |

|             |          |          |  |             |                                                                      |              |
|-------------|----------|----------|--|-------------|----------------------------------------------------------------------|--------------|
|             |          |          |  | XP_036829.5 | similar to tropomyosin, fibroblast                                   | 365 e-101    |
|             |          |          |  | A24199      | tropomyosin NM, skeletal muscle                                      | 365 e-101    |
|             |          |          |  | CAA27798.1  | skeletal muscle tropomyosin (AA 1-285)                               | 365 e-101    |
|             |          |          |  | AAH08407.1  | AAH08407 Unknown (protein for MGC:14532)                             | 365 e-101    |
|             |          |          |  | AAH08425.1  | AAH08425 Unknown (protein for MGC:14582)                             | 365 e-101    |
|             |          |          |  | I209280A    | tropomyosin                                                          | 365 e-101    |
|             |          |          |  | P09493      | TPM1 HUMAN Tropomyosin 1 alpha chain (Alpha-tropomyosin)             | 345 8.00E-95 |
|             |          |          |  | A25825      | tropomyosin alpha chain, cardiac and skeletal muscle                 | 345 8.00E-95 |
|             |          |          |  | AAA61225.1  | skeletal muscle tropomyosin                                          | 345 8.00E-95 |
|             |          |          |  | P07951      | TPM2 HUMAN Tropomyosin beta chain (Tropomyosin 2) (Beta-tropomyosin) | 326 3.00E-89 |
|             |          |          |  | S00922      | tropomyosin beta, skeletal muscle                                    | 326 3.00E-89 |
|             |          |          |  | CAA29971.1  | beta-tropomyosin (AA 1-284)                                          | 326 3.00E-89 |
|             |          |          |  | AAH07433.1  | AAH07433 Similar to tropomyosin 1 (alpha)                            | 325 7.00E-89 |
|             |          |          |  | NP_689476.1 | tropomyosin 3                                                        | 315 9.00E-86 |
|             |          |          |  | BAC03946.1  | unnamed protein product                                              | 315 9.00E-86 |
|             |          |          |  | AAA61226.1  | skeletal muscle tropomyosin                                          | 310 2.00E-84 |
|             |          |          |  | BAB14554.1  | unnamed protein product                                              | 300 2.00E-81 |
|             |          |          |  | NP_000357.2 | tropomyosin 1 (alpha)                                                | 281 1.00E-75 |
|             |          |          |  | A27674      | tropomyosin 3, fibroblast                                            | 281 1.00E-75 |
|             |          |          |  | AAA36771.1  | tropomyosin                                                          | 281 1.00E-75 |
|             |          |          |  | T08796      | tropomyosin                                                          | 278 1.00E-74 |
|             |          |          |  | CAB43309.1  | hypothetical protein                                                 | 278 1.00E-74 |
| NM_011825   | Mm.25760 | F:(C-IR) |  | NP_071914.1 | hypothetical protein FLJ21195 similar to protein related to DAC      | 308 5.00E-83 |
| NP_035955.1 |          | -2.24    |  |             |                                                                      |              |
|             |          |          |  | BAB15026.1  | unnamed protein product                                              | 308 5.00E-83 |
| NM_009831   | Mm.2103  | F:(C-IR) |  | NP_004051.1 | cyclin G1                                                            | 543 e-154    |
| NP_033961.1 |          | -2.2     |  |             |                                                                      |              |
|             |          |          |  | P51959      | CGG1_HUMAN Cyclin G1 (Cyclin G)                                      | 543 e-154    |
|             |          |          |  | G02401      | cyclin G1                                                            | 543 e-154    |



|             |          |               |  |             |                                                                                                                                                                                                      |  |     |       |
|-------------|----------|---------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-------|
|             |          |               |  | AAC41977.1  | cyclin G1                                                                                                                                                                                            |  | 543 | e-154 |
|             |          |               |  | AAC50688.1  | cyclin G1                                                                                                                                                                                            |  | 543 | e-154 |
|             |          |               |  | BAA11353.1  | cyclin G                                                                                                                                                                                             |  | 543 | e-154 |
|             |          |               |  | AAH00196.1  | cyclin G1                                                                                                                                                                                            |  | 543 | e-154 |
|             |          |               |  | 2210321A    | cyclin G1                                                                                                                                                                                            |  | 543 | e-154 |
|             |          |               |  | AAH07093.   | cyclin G1                                                                                                                                                                                            |  | 541 | e-154 |
|             |          |               |  | BAA13007.1  | cyclin G                                                                                                                                                                                             |  | 514 | e-146 |
|             |          |               |  | CAA54821.1  | cyclin G1                                                                                                                                                                                            |  | 462 | e-130 |
|             |          |               |  | G02523      | cyclin G                                                                                                                                                                                             |  | 421 | e-117 |
|             |          |               |  | AAB03903.1  | cyclin G                                                                                                                                                                                             |  | 421 | e-117 |
|             |          |               |  | AAH32518.1  | Similar to cyclin G2                                                                                                                                                                                 |  | 292 | 8E-79 |
|             |          |               |  | NP_004345.1 | cyclin G2                                                                                                                                                                                            |  | 292 | 8E-79 |
|             |          |               |  | Q16589      | CGG2_HUMAN Cyclin G2                                                                                                                                                                                 |  | 292 | 8E-79 |
|             |          |               |  | AAC41978.1  | cyclin G2                                                                                                                                                                                            |  | 292 | 8E-79 |
|             |          |               |  | AAC50689.1  | cyclin G2                                                                                                                                                                                            |  | 292 | 8E-79 |
|             |          |               |  | AAN40704.1  | cyclin G2                                                                                                                                                                                            |  | 292 | 8E-79 |
|             |          |               |  | 2210321B    | cyclin G2                                                                                                                                                                                            |  | 292 | 8E-79 |
| NM_021282   | Mm.21758 | F:(C-IR)      |  | NP_000764.1 | cytochrome P450, subfamily IIE, polypeptide I; microsomal monooxygenase; xenobiotic monooxygenase; flavoprotein-linked monooxygenase; cytochrome P450, subfamily IIE (ethanol-inducible)             |  | 792 | 0     |
| NP_067257.1 |          | F:(C-D) -2.19 |  |             |                                                                                                                                                                                                      |  |     |       |
|             |          | F:(C-D) -2.5  |  |             |                                                                                                                                                                                                      |  |     |       |
|             |          |               |  | P05181      | CPE1_HUMAN Cytochrome P450 2E1 (CYP11E1) (P450-J)                                                                                                                                                    |  | 792 | 0     |
|             |          |               |  | A31949      | cytochrome P450 2E                                                                                                                                                                                   |  | 792 | 0     |
|             |          |               |  | AAA52155.1  | cytochrome P450IIE1                                                                                                                                                                                  |  | 792 | 0     |
|             |          |               |  | AAA35743.1  | cytochrome P450j                                                                                                                                                                                     |  | 792 | 0     |
|             |          |               |  | AAF13601.1  | AF182276 1 cytochrome P450-2E1                                                                                                                                                                       |  | 790 | 0     |
|             |          |               |  | AAD13753.1  | cytochrome P450 2E1                                                                                                                                                                                  |  | 751 | 0     |
|             |          |               |  | NP_000760.1 | cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 19; mephenytoin 4'-hydroxylase; microsomal monooxygenase; xenobiotic monooxygenase; <b>flavoprotein-linked monooxygenase</b> |  | 557 | e-158 |
|             |          |               |  | P33261      | CPCJ_HUMAN Cytochrome P450 2C19 (CYP11C19) (P450-11A) (Mephenytoin 4-hydroxylase) (CYP11C17) (P450-254C)                                                                                             |  | 557 | e-158 |

|             |          |                   |  |             |                                                                                                                                                                                                                                                      |  |           |
|-------------|----------|-------------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------|
|             |          |                   |  | AAB59426.1  | cytochrome                                                                                                                                                                                                                                           |  | 557 e-158 |
|             |          |                   |  | NP_000763.1 | cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 18;<br>cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 17;<br>microsomal monooxygenase; flavoprotein-linked monooxygenase                            |  | 556 e-158 |
|             |          |                   |  | AAB59356.1  | cytochrome                                                                                                                                                                                                                                           |  | 556 e-158 |
|             |          |                   |  | P33260      | CPCI_HUMAN Cytochrome P450 2C18 (CYP11C18) (P450-6B/29C)                                                                                                                                                                                             |  | 553 e-157 |
|             |          |                   |  | A61269      | cytochrome P450 2C18                                                                                                                                                                                                                                 |  | 553 e-157 |
|             |          |                   |  | AAA02630.1  | cytochrome P-4502C18                                                                                                                                                                                                                                 |  | 553 e-157 |
|             |          |                   |  | BAA00123.1  | cytochrome P-450                                                                                                                                                                                                                                     |  | 550 e-156 |
|             |          |                   |  | NP_000762.2 | cytochrome P450, subfamily IIC, polypeptide 9; cytochrome P450, subfamily IIC<br>(mephenytoin 4-hydroxylase), polypeptide 10; mephenytoin 4-hydroxylase;<br>microsomal monooxygenase; xenobiotic monooxygenase; flavoprotein-linked<br>monooxygenase |  | 550 e-156 |
|             |          |                   |  | P11712      | CPC9_HUMAN Cytochrome P450 2C9 (CYP11C9) (P450 PB-1) (P450 MP-4) (S-<br>mephenytoin 4-hydroxylase) (P-450MP)                                                                                                                                         |  | 550 e-156 |
|             |          |                   |  | B38462      | S-mephenytoin 4-hydroxylase (EC 1.14.14.-) cytochrome P450 2C9                                                                                                                                                                                       |  | 550 e-156 |
|             |          |                   |  | I313295A    | cytochrome P450                                                                                                                                                                                                                                      |  | 550 e-156 |
|             |          |                   |  | F38462      | S-mephenytoin 4'-hydroxylase (EC 1.14.14.-) cytochrome P450 2C19                                                                                                                                                                                     |  | 550 e-156 |
|             |          |                   |  | AAB23864.2  | cytochrome P-450                                                                                                                                                                                                                                     |  | 545 e-155 |
| AK019452    | Mm.29952 | F:(C-IR)<br>-2.19 |  | NP_078847.1 | hypothetical protein FLJ22940                                                                                                                                                                                                                        |  | 258 9E-69 |
| BAB31728.1  |          |                   |  |             |                                                                                                                                                                                                                                                      |  |           |
|             |          |                   |  | AAH01381.1  | polymerase (RNA) III (DNA directed) polypeptide K (12.3 kDa)                                                                                                                                                                                         |  | 258 9E-69 |
|             |          |                   |  | AAH09179.1  | hypothetical protein FLJ22940                                                                                                                                                                                                                        |  | 258 9E-69 |
|             |          |                   |  | AAK61211.1  | AE006462 3 Minus -99 protein                                                                                                                                                                                                                         |  | 258 9E-69 |
|             |          |                   |  | BAB15505.1  | unnamed protein product                                                                                                                                                                                                                              |  | 256 4E-68 |
| NM_008832   | Mm.42254 | F:(C-IR)<br>-2.18 |  | NP_002628.1 | phosphorylase kinase, alpha 1 (muscle); phosphorylase kinase, alpha 1 (muscle),<br>muscle glycogenosis; Phosphorylase kinase, muscle, alpha polypeptide                                                                                              |  | 2244 0    |
| NP_032858.1 |          |                   |  |             |                                                                                                                                                                                                                                                      |  |           |
|             |          |                   |  | P46020      | KPBI_HUMAN Phosphorylase B kinase alpha regulatory chain, skeletal muscle<br>isoform (Phosphorylase kinase alpha M subunit)                                                                                                                          |  | 2244 0    |
|             |          |                   |  | I38111      | phosphorylase kinase (EC 2.7.1.38) alpha-1 chain                                                                                                                                                                                                     |  | 2244 0    |

|                          |                               |  |  |             |                                                                                                                                                                             |           |
|--------------------------|-------------------------------|--|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                          |                               |  |  | CAA52083.1  | phosphorylase kinase                                                                                                                                                        | 2244 0    |
|                          |                               |  |  | NP_000283.1 | phosphorylase kinase, alpha 2 (liver), Phosphorylase kinase deficiency, liver (glycogen storage disease; phosphorylase kinase, alpha 2 (liver), glycogen storage disease IX | 1628 0    |
|                          |                               |  |  | P46019      | KPB2_HUMAN Phosphorylase B kinase alpha regulatory chain, liver isoform (Phosphorylase kinase alpha L subunit)                                                              | 1628 0    |
|                          |                               |  |  | CAA56662.1  | phosphorylase kinase                                                                                                                                                        | 1628 0    |
|                          |                               |  |  | BAA07606.1  | phosphorylase kinase alpha subunit                                                                                                                                          | 1628 0    |
|                          |                               |  |  | AAD32846.1  | phosphorylase kinase alpha subunit                                                                                                                                          | 1628 0    |
|                          |                               |  |  | AAH14036.1  | AAH14036 Similar to phosphorylase kinase, alpha 2 (liver)                                                                                                                   | 1624 0    |
|                          |                               |  |  | CAB86408.1  | dI499B10.2 (phosphorylase kinase, alpha 2 (liver) (PYK))                                                                                                                    | 631 e-180 |
|                          |                               |  |  | AAB27307.1  | phosphorylase kinase alpha subunit liver isoform, PHKA2 {EC 2.7.1.38} [human, hepatoma, Peptide Partial, 377 aa]                                                            | 473 e-132 |
|                          |                               |  |  | S74251      | phosphorylase kinase (EC 2.7.1.38) beta chain                                                                                                                               | 461 e-129 |
|                          |                               |  |  | AAH33657.1  | Similar to phosphorylase kinase, beta                                                                                                                                       | 461 e-129 |
| NM_023831<br>NP_076320.1 | Mm.30006<br>F:(C-IR)<br>-2.16 |  |  | CAB96537.1  | hypothetical protein                                                                                                                                                        | 465 e-131 |
|                          |                               |  |  | CAB66868.1  | hypothetical protein                                                                                                                                                        | 465 e-131 |
|                          |                               |  |  | AAH11647.1  | AAH11647 Similar to hypothetical protein                                                                                                                                    | 465 e-131 |
|                          |                               |  |  | AAH12802.1  | AAH12802 Similar to hypothetical protein                                                                                                                                    | 465 e-131 |
|                          |                               |  |  | AAH22856.1  | hypothetical protein                                                                                                                                                        | 465 e-131 |
|                          |                               |  |  | NP_064538.2 | hypothetical protein FLJ21827                                                                                                                                               | 465 e-131 |
|                          |                               |  |  | BAB15146.1  | unnamed protein product                                                                                                                                                     | 465 e-131 |
| AK004839<br>XP_129259.1  | Mm.2605<br>F:(C-IR)<br>-2.15  |  |  | NP_006735.1 | retinol-binding protein 4, plasma precursor                                                                                                                                 | 343 2E-94 |
|                          |                               |  |  | pir VAHU    | plasma retinol-binding protein precursor                                                                                                                                    | 343 2E-94 |
|                          |                               |  |  | CAA24959.1  | precursor RBP                                                                                                                                                               | 343 2E-94 |
|                          |                               |  |  | P02753      | Plasma retinol-binding protein precursor (PRBP) (RBP) (PRO2222)                                                                                                             | 341 1E-93 |
|                          |                               |  |  | AAH20633.1  | Similar to retinol binding protein 4, plasma                                                                                                                                | 341 1E-93 |
|                          |                               |  |  | XP_005907.5 | similar to Plasma retinol-binding protein precursor (PRBP) (RBP) (PRO2222)                                                                                                  | 341 1E-93 |

|                          |          |                   |  |             |                                                                                                                                                       |     |          |
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|                          |          |                   |  | IRBP        | Retinol Binding Protein                                                                                                                               | 340 | 2E-93    |
|                          |          |                   |  | IBRP        | Retinol Binding Protein (Holo Form)                                                                                                                   | 340 | 2E-93    |
|                          |          |                   |  | IBRQ        | Retinol Binding Protein (Apo Form)                                                                                                                    | 340 | 2E-93    |
|                          |          |                   |  | 1401251A    | retinol binding protein                                                                                                                               | 340 | 2E-93    |
|                          |          |                   |  | 1QAB        | E Chain E, The Structure Of Human Retinol Binding Protein With Its Carrier Protein Transthyretin Reveals Interaction With The Carboxy Terminus Of Rbp | 328 | 9E-90    |
|                          |          |                   |  | 1QAB        | F Chain F, The Structure Of Human Retinol Binding Protein With Its Carrier Protein Transthyretin Reveals Interaction With The Carboxy Terminus Of Rbp | 328 | 9E-90    |
|                          |          |                   |  | AAF69622.1  | AF119917 30 PRO2222                                                                                                                                   | 288 | 6E-78    |
|                          |          |                   |  | CAA26553.1  | RBP                                                                                                                                                   | 199 | 5E-51    |
| NM_011823<br>NP_035953.1 | Mm.89979 | F:(C-IR)<br>-2.12 |  | AAD50531.1  | AF039686_1 G-protein coupled receptor GPR34                                                                                                           | 698 | 0        |
|                          |          |                   |  | NP_005291.1 | G protein-coupled receptor 34                                                                                                                         | 697 | 0        |
|                          |          |                   |  | Q9UPC5      | GP34 HUMAN Probable G protein-coupled receptor GPR34                                                                                                  | 697 | 0        |
|                          |          |                   |  | AAD17248.1  | orphan G protein-coupled receptor                                                                                                                     | 697 | 0        |
|                          |          |                   |  | BAB55362.1  | unnamed protein product                                                                                                                               | 697 | 0        |
|                          |          |                   |  | AAH20678.1  | AAH20678 G protein-coupled receptor 34                                                                                                                | 697 | 0        |
|                          |          |                   |  |             |                                                                                                                                                       |     |          |
| NM_025950<br>NP_080226.1 | Mm.78875 | F:(C-IR)<br>-2.08 |  | CAC12705.1  | bA6124.4 (A novel protein similar to cell division cycle control protein 37(CDC37))                                                                   | 514 | e-145    |
|                          |          |                   |  | AAH14133.1  | AAH14133 Unknown (protein for MGC:20783)                                                                                                              | 514 | e-145    |
|                          |          |                   |  | NP_060383.1 | Hsp90-associating relative of Cdc37; hypothetical protein FLJ20639                                                                                    | 513 | e-145    |
|                          |          |                   |  | BAA91304.1  | unnamed protein product                                                                                                                               | 513 | e-145    |
|                          |          |                   |  | BAA91206.1  | unnamed protein product                                                                                                                               | 303 | 1.00E-81 |
|                          |          |                   |  | NP_008996.1 | CDC37 homolog; CDC37 (cell division cycle 37, S. cerevisiae, homolog); CDC37 (S. cerevisiae) homolog                                                  | 210 | 9.00E-54 |
|                          |          |                   |  | Q16543      | CC37_HUMAN Hsp90 co-chaperone Cdc37 (Hsp90 chaperone protein kinase-targeting subunit) (p50Cdc37)                                                     | 210 | 9.00E-54 |
|                          |          |                   |  | G02313      | CDC37 homolog                                                                                                                                         | 210 | 9.00E-54 |

|             |          |          |  |             |                                                                                                           |     |          |
|-------------|----------|----------|--|-------------|-----------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |          |  | AAB63979.1  | CDC37 homolog                                                                                             | 210 | 9.00E-54 |
|             |          |          |  | AAB04798.1  | CDC37 homolog                                                                                             | 210 | 9.00E-54 |
|             |          |          |  | AAH00083.1  | AAH00083 CDC37 (cell division cycle 37, <i>S. cerevisiae</i> , homolog)                                   | 210 | 9.00E-54 |
|             |          |          |  | AAH08793.1  | AAH08793 CDC37 (cell division cycle 37, <i>S. cerevisiae</i> , homolog)                                   | 210 | 9.00E-54 |
| NM_008452   | Mm.26938 | F:(C-IR) |  | AAD55891.1  | AF134053_1 Kruppel-like factor LKLF                                                                       | 431 | e-120    |
| NP_032478.1 |          | -2.05    |  |             |                                                                                                           |     |          |
|             |          |          |  | AAD25076.1  | AF123344_1 Kruppel-like zinc finger transcription factor                                                  | 429 | e-120    |
|             |          |          |  | NP_057354.1 | Kruppel-like factor                                                                                       | 429 | e-120    |
|             |          |          |  | Q9Y5W3      | KLF2 HUMAN Kruppel-like factor 2 (Lung kruppel-like factor)                                               | 429 | e-120    |
|             |          |          |  | AAF13295.1  | AF205849_1 Kruppel-like factor                                                                            | 429 | e-120    |
|             |          |          |  | AAC03462.1  | EZF                                                                                                       | 213 | 5E-55    |
|             |          |          |  | O43474      | KLF4_HUMAN Kruppel-like factor 4 (Epithelial zinc-finger protein EZF) (Gut-enriched Krueppel-like factor) | 213 | 5E-55    |
|             |          |          |  | AAD42165.1  | AF105036_1 zinc finger transcription factor GKLF                                                          | 213 | 5E-55    |
|             |          |          |  | AAH29923.1  | Kruppel-like factor 4 (gut)                                                                               | 213 | 5E-55    |
|             |          |          |  | NP_004226.1 | Kruppel-like factor 4 (gut); endothelial Kruppel-like zinc finger protein                                 | 213 | 5E-55    |
|             |          |          |  | AAB48399.1  | hEZF                                                                                                      | 213 | 5E-55    |
|             |          |          |  | AAH30811.1  | Similar to Kruppel-like factor 4 (gut)                                                                    | 213 | 5E-55    |
|             |          |          |  | AAH35342.1  | Similar to Kruppel-like factor 2 (lung)                                                                   | 211 | 3E-54    |
| NM_020007   | Mm.14199 | F:(C-IR) |  | AAK94915.1  | AF401998_1 muscleblind 41kD isoform                                                                       | 569 | e-166    |
| NP_064391.1 | 3        | -2.04    |  |             |                                                                                                           |     |          |
|             |          |          |  | NP_066368.1 | muscleblind (Drosophila)-like                                                                             | 546 | e-160    |
|             |          |          |  | BAA24858.1  | KIAA0428                                                                                                  | 546 | e-160    |
|             |          |          |  | Q9NR56      | MBNL_HUMAN Muscleblind-like protein (Triplet-expansion RNA-binding protein)                               | 537 | e-157    |
|             |          |          |  | CAA74155.1  | MBNL protein                                                                                              | 537 | e-157    |
|             |          |          |  | NP_659002.1 | muscleblind-like protein MBLL39 isoform 1                                                                 | 449 | e-125    |
|             |          |          |  | AAM09798.1  | AF491866_1 muscleblind-like protein MLP1                                                                  | 449 | e-125    |
|             |          |          |  | AAM50085.1  | muscleblind-like protein MBLL39                                                                           | 427 | e-119    |
|             |          |          |  | NP_060858.2 | CHCR isoform G                                                                                            | 387 | e-106    |

|             |          |                   |  |             |                                                                                                                     |     |          |
|-------------|----------|-------------------|--|-------------|---------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |                   |  | Q9NUK0      | MBXL_HUMAN Muscblind-like X-linked protein (Cys3His CCG1-required protein) (HCHCR protein)                          | 387 | e-106    |
|             |          |                   |  | AAL65661.1  | CHCR isoform G                                                                                                      | 387 | e-106    |
|             |          |                   |  | BAB85648.1  | hCHCR-G                                                                                                             | 387 | e-106    |
|             |          |                   |  | CAD20869.1  | CHCR protein                                                                                                        | 387 | e-106    |
|             |          |                   |  | AAM09533.1  | AF491305 1 MBLX39                                                                                                   | 387 | e-106    |
|             |          |                   |  | NP_005748.1 | muscblind-like protein MBLX39 isoform 2                                                                             | 377 | e-103    |
|             |          |                   |  | AAC67242.1  | zinc finger protein                                                                                                 | 377 | e-103    |
|             |          |                   |  | BAB85649.1  | hCHCR-R                                                                                                             | 343 | 1.00E-93 |
|             |          |                   |  | CAD20870.1  | CHCR protein                                                                                                        | 343 | 1.00E-93 |
|             |          |                   |  | AAL87670.1  | AF467070 1 Cys3His CCG1-required protein isoform R                                                                  | 343 | 1.00E-93 |
|             |          |                   |  | AAK82889.1  | AF395876 1 36 kDa muscblind protein EXP36                                                                           | 286 | 7.00E-82 |
| NM_009883   | Mm.4863  | F:(C-IR)<br>-2.03 |  | CAC14276.1  | bA112L6.1 (CCAAT/enhancer binding protein (C/EBP), beta)                                                            | 271 | 2E-72    |
| NP_034013.1 |          |                   |  |             |                                                                                                                     |     |          |
|             |          |                   |  | AAH07538.1  | Unknown (protein for MGC:15409)                                                                                     | 271 | 2E-72    |
|             |          |                   |  | AAL55792.1  | AF289608_1 unknown                                                                                                  | 271 | 2E-72    |
|             |          |                   |  | AAH21931.1  | Unknown (protein for MGC:32080)                                                                                     | 271 | 2E-72    |
|             |          |                   |  | AAN86350.1  | CCAAT/enhancer binding protein (C/EBP), beta                                                                        | 271 | 2E-72    |
|             |          |                   |  | NP_005185.1 | CCAAT/enhancer binding protein (C/EBP), beta; CCAAT/enhancer-binding protein (C/EBP), beta (transcription factor-5) | 271 | 2E-72    |
|             |          |                   |  | P17676      | CEBB_HUMAN CCAAT/enhancer binding protein beta (C/EBP beta) (Nuclear factor NF-IL6) (Transcription factor 5)        | 271 | 2E-72    |
|             |          |                   |  | S12788      | transcription factor NF-IL6                                                                                         | 271 | 2E-72    |
|             |          |                   |  | CAA36794.1  | nuclear factor NF-IL6 (AA 1-345)                                                                                    | 271 | 2E-72    |
| AK004002    | Mm.19844 | F:(C-IR)<br>-2.02 |  | CAA36441.1  | five-lipoxygenase activating protein (FLAP)                                                                         | 282 | 4E-76    |
| BAB23117.1  |          |                   |  |             |                                                                                                                     |     |          |
|             |          |                   |  | NP_001620.2 | arachidonate 5-lipoxygenase-activating protein; five-lipoxygenase activating protein; MK-886-binding protein        | 282 | 4E-76    |
|             |          |                   |  | P20292      | FLAP_HUMAN 5-lipoxygenase activating protein (FLAP) (MK-886-binding protein)                                        | 282 | 4E-76    |

|             |          |                   |             |                                                                                                                         |           |
|-------------|----------|-------------------|-------------|-------------------------------------------------------------------------------------------------------------------------|-----------|
|             |          |                   | A39824      | 5-lipoxygenase-activating protein                                                                                       | 282 4E-76 |
|             |          |                   | AAA35845.1  | 5-lipoxygenase activating protein                                                                                       | 282 4E-76 |
|             |          |                   | 1603359A    | lipoxygenase activating protein                                                                                         | 279 3E-75 |
| NM_009776   | Mm.38888 | F:(C-IR)<br>-2.02 | AAH11171.1  | serine (or cysteine) proteinase inhibitor, clade G (C1 inhibitor), member 1                                             | 634 0     |
| NP_033906.1 |          |                   |             |                                                                                                                         |           |
|             |          |                   | P05155      | IC1_HUMAN Plasma protease C1 inhibitor precursor (C1 Inh) (C1Inh)                                                       | 633 0     |
|             |          |                   | ITHUC1      | complement C1 inhibitor precursor [validated]                                                                           | 633 0     |
|             |          |                   | CAA38358.1  | C1 inhibitor                                                                                                            | 633 0     |
|             |          |                   | CAA30314.1  | C1 inhibitor                                                                                                            | 633 0     |
|             |          |                   | AAM21515.1  | AF435921_1 C1 esterase inhibitor                                                                                        | 633 0     |
|             |          |                   | NP_000053.1 | complement component 1 inhibitor precursor; serine (or cysteine) proteinase inhibitor, clade G (C1 inhibitor), member 1 | 632 0     |
|             |          |                   | AAB59387.1  | plasma protease (C1) inhibitor precursor                                                                                | 632 0     |
|             |          |                   | AAA35613.1  | plasma protease (C1) inhibitor precursor                                                                                | 632 0     |
|             |          |                   | CAA30469.1  | C1 inhibitor (AA 155-478) (1 is 2nd base in codon)                                                                      | 517 e-146 |
|             |          |                   | AAA51848.1  | C1-inhibitor                                                                                                            | 454 e-127 |
|             |          |                   | AAA51849.1  | C1 inhibitor                                                                                                            | 307 3E-83 |
| NM_011082   | Mm.4317  | F:(C-IR)<br>-2.02 | XP_052013.1 | similar to polymeric immunoglobulin receptor                                                                            | 930 0     |
| NP_035212.1 |          |                   |             |                                                                                                                         |           |
|             |          |                   | AAN65630.1  | hepatocellular carcinoma associated protein TB6                                                                         | 930 0     |
|             |          |                   | NP_002635.1 | polymeric immunoglobulin receptor                                                                                       | 927 0     |
|             |          |                   | P01833      | PIGR_HUMAN Polymeric-immunoglobulin receptor precursor (Poly-Ig receptor) (PIGR) [Contains: Secretary component]        | 927 0     |
|             |          |                   | QRHUGS      | secretory component precursor [validated]                                                                               | 927 0     |
|             |          |                   | AAB20203.1  | transmembrane secretory component; poly-Ig receptor; SC                                                                 | 927 0     |
|             |          |                   | AAB23176.1  | transmembrane secretory component; SC; poly-Ig receptor                                                                 | 927 0     |
|             |          |                   | CAA51532.1  | Polymeric immunoglobulin receptor                                                                                       | 927 0     |
|             |          |                   | AAA36102.1  | poly-Ig receptor                                                                                                        | 817 0     |
| NM_010274   | Mm.3711  | F:(C-IR)<br>-2.01 | G02093      | glycerol-3-phosphate dehydrogenase (EC 1.1.99.5), mitochondrial precursor                                               | 1268 0    |
| NP_034404.1 |          |                   |             |                                                                                                                         |           |

|             |          |          |  |             |                                                                                                                             |              |
|-------------|----------|----------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------|--------------|
|             |          |          |  | AAB60403.1  | glycerol-3-phosphate dehydrogenase                                                                                          | 1268 0       |
|             |          |          |  | AAC50556.1  | glycerol-3-phosphate dehydrogenase                                                                                          | 1268 0       |
|             |          |          |  | NP_000399.1 | glycerol-3-phosphate dehydrogenase 2 (mitochondrial)                                                                        | 1266 0       |
|             |          |          |  | P43304      | GPDH_HUMAN Glycerol-3-phosphate dehydrogenase, mitochondrial precursor (GPDH-M)                                             | 1266 0       |
|             |          |          |  | AAA65701.1  | mitochondrial glycerol-3-phosphate dehydrogenase                                                                            | 1266 0       |
|             |          |          |  | AAG33851.1  | AF311325 1 glycerol-3-phosphate dehydrogenase 3                                                                             | 1071 0       |
|             |          |          |  | AAB50200.1  | glycerol-3-phosphate dehydrogenase                                                                                          | 684 0        |
|             |          |          |  | AAH19874.1  | AAH19874 Similar to glycerol-3-phosphate dehydrogenase 2 (mitochondrial)                                                    | 624 e-178    |
|             |          |          |  | XP_092005.2 | similar to Glycerol-3-phosphate dehydrogenase, mitochondrial precursor (GPDH-M)                                             | 320 8.00E-87 |
|             |          |          |  |             |                                                                                                                             |              |
| NM_010801   | Mm.10414 | F:(C-IR) |  | NP_071888.1 | myeloid leukemia factor 1                                                                                                   | 435 e-122    |
| NP_034931.1 |          | -2.01    |  |             |                                                                                                                             |              |
|             |          |          |  | P58340      | MLF1_HUMAN Myeloid leukemia factor 1 (Myelodysplasia-myeloid leukemia factor 1)                                             | 435 e-122    |
|             |          |          |  | AAA99997.1  | t(3;5)(q25.1;p34) fusion gene                                                                                               | 435 e-122    |
|             |          |          |  | AAH07045.1  | AAH07045 myeloid leukemia factor 1                                                                                          | 435 e-122    |
|             |          |          |  | BAC04885.1  | unnamed protein product                                                                                                     | 396 e-110    |
|             |          |          |  | BAB71320.1  | unnamed protein product                                                                                                     | 383 e-106    |
| NM_028784   | Mm.17403 | F:(C-IR) |  | CAC36886.1  | bA525O21.1 (coagulation factor XIII, A1 polypeptide)                                                                        | 482 e-135    |
| NP_083060.1 |          | -2.01    |  |             |                                                                                                                             |              |
|             |          |          |  | IFI13       | A Chain A, Recombinant Human Cellular Coagulation Factor Xiii                                                               | 482 e-135    |
|             |          |          |  | IFI13       | B Chain B, Recombinant Human Cellular Coagulation Factor Xiii                                                               | 482 e-135    |
|             |          |          |  | IGGT        | A Chain A, Coagulation Factor Xiii (A-Subunit Zymogen) (E.C.2.3.2.13) (Protein-Glutamine Gamma-Glutamyltransferase A Chain) | 482 e-135    |
|             |          |          |  | IGGT        | B Chain B, Coagulation Factor Xiii (A-Subunit Zymogen) (E.C.2.3.2.13) (Protein-Glutamine Gamma-Glutamyltransferase A Chain) | 482 e-135    |
|             |          |          |  | IGGU        | B Chain B, Human Factor Xiii With Calcium Bound In The Ion Site                                                             | 482 e-135    |
|             |          |          |  | IGGY        | B Chain B, Human Factor Xiii With Ytterbium Bound In The Ion Site                                                           | 482 e-135    |
|             |          |          |  | IQRK        | B Chain B, Human Factor Xiii With Strontium Bound In The Ion Site                                                           | 482 e-135    |



|             |          |          |  |             |                                                                                                                                       |     |          |
|-------------|----------|----------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |          |  | IGGY        | A Chain A, Human Factor Xiii With Ytterbium Bound In The Ion Site                                                                     | 482 | e-135    |
|             |          |          |  | IGGU        | A Chain A, Human Factor Xiii With Calcium Bound In The Ion Site                                                                       | 482 | e-135    |
|             |          |          |  | IQRK        | A Chain A, Human Factor Xiii With Strontium Bound In The Ion Site                                                                     | 482 | e-135    |
|             |          |          |  | XP_165833.1 | similar to coagulation factor XIII, A1 polypeptide                                                                                    | 482 | e-135    |
|             |          |          |  | AAL12161.1  | AF418272_1 coagulation factor XIII, A1 polypeptide                                                                                    | 482 | e-135    |
|             |          |          |  | AAA52415.1  | factor XIII a subunit                                                                                                                 | 481 | e-135    |
|             |          |          |  | 1EVU        | A Chain A, Human Factor Xiii With Calcium Bound In The Ion Site                                                                       | 481 | e-135    |
|             |          |          |  | 1EVU        | B Chain B, Human Factor Xiii With Calcium Bound In The Ion Site                                                                       | 481 | e-135    |
|             |          |          |  | NP_000120.1 | coagulation factor XIII A1 subunit precursor; Coagulation factor XIII, A polypeptide; Tgase                                           | 481 | e-135    |
|             |          |          |  | AAA52488.1  | clotting factor XIIIa precursor (EC 2.3.2.13)                                                                                         | 481 | e-135    |
|             |          |          |  | P00488      | F13A_HUMAN Coagulation factor XIII A chain precursor (Protein-glutamine gamma-glutamyltransferase A chain) (Transglutaminase A chain) | 481 | e-135    |
|             |          |          |  | EKHUX       | protein-glutamine gamma-glutamyltransferase (EC 2.3.2.13), plasma                                                                     | 481 | e-135    |
|             |          |          |  | 1FIE        | B Chain B, Recombinant Human Coagulation Factor Xiii                                                                                  | 481 | e-135    |
|             |          |          |  | 1FIE        | A Chain A, Recombinant Human Coagulation Factor Xiii                                                                                  | 481 | e-135    |
|             |          |          |  | AAA52489.1  | factor XIII precursor                                                                                                                 | 481 | e-135    |
|             |          |          |  | AAH27963.1  | coagulation factor XIII, A1 polypeptide                                                                                               | 480 | e-135    |
| NM_010439   | Mm.16421 | F:(C-IR) |  | NP_002119.1 | high-mobility group box 1; high mobility group box 1; high-mobility group (nonhistone chromosomal) protein 1                          | 324 | 3.00E-88 |
| NP_034569.1 |          | -2       |  |             |                                                                                                                                       |     |          |
|             |          |          |  | P09429      | HMG1 HUMAN High mobility group protein 1 (HMG-1)                                                                                      | 324 | 3.00E-88 |
|             |          |          |  | S02826      | nonhistone chromosomal protein HMG-1                                                                                                  | 324 | 3.00E-88 |
|             |          |          |  | CAA31110.1  | HMG-1 protein (AA 1-215)                                                                                                              | 324 | 3.00E-88 |
|             |          |          |  | AAB08987.1  | on-histone chromatin protein HMG1                                                                                                     | 324 | 3.00E-88 |
|             |          |          |  | AAH03378.1  | AAH03378 high-mobility group (nonhistone chromosomal) protein 1                                                                       | 324 | 3.00E-88 |
|             |          |          |  | AAH30981.1  | high-mobility group (nonhistone chromosomal) protein 1                                                                                | 324 | 3.00E-88 |
|             |          |          |  | BAA09924.1  | HMG-1                                                                                                                                 | 321 | 3.00E-87 |
|             |          |          |  | S29857      | nonhistone chromosomal protein HMG-1                                                                                                  | 318 | 2.00E-86 |
|             |          |          |  | CAB92731.1  | dJ579F20.1 (high-mobility group (nonhistone chromosomal) protein 1-like 1)                                                            | 310 | 7.00E-84 |
|             |          |          |  | Q9UGV6      | HM1X HUMAN High mobility group protein 1-like 10 (HMG-1L10)                                                                           | 301 | 2.00E-81 |
|             |          |          |  | CAB62951.1  | bK445C9.3 (high-mobility group (nonhistone chromosomal) protein 1-like 10)                                                            | 301 | 2.00E-81 |

|                          |         |                   |            |                                                                                                   |                                                                                                                                 |     |          |
|--------------------------|---------|-------------------|------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |         |                   |            | AAF19244.1                                                                                        | AC007277_1 similar to nonhistone chromosomal protein HMG-1 [Homo sapiens]; probable pseudogene; similar to P09429 (PID:g123369) | 285 | 2.00E-76 |
|                          |         |                   |            | AAH00903.2                                                                                        | AAH00903 high-mobility group (nonhistone chromosomal) protein 2                                                                 | 283 | 1.00E-75 |
|                          |         |                   |            | NP_002120.1                                                                                       | high-mobility group box 2; high-mobility group (nonhistone chromosomal) protein 2                                               | 283 | 1.00E-75 |
|                          |         |                   |            | P26583                                                                                            | HMG2 HUMAN High mobility group protein 2 (HMG-2)                                                                                | 283 | 1.00E-75 |
|                          |         |                   |            | NSHUH2                                                                                            | nonhistone chromosomal protein HMG-2                                                                                            | 283 | 1.00E-75 |
|                          |         |                   |            | CAA44395.1                                                                                        | HMG-2                                                                                                                           | 283 | 1.00E-75 |
|                          |         |                   |            | AAA58659.1                                                                                        | high mobility group 2 protein                                                                                                   | 283 | 1.00E-75 |
|                          |         |                   |            | AAH01063.1                                                                                        | AAH01063 high-mobility group (nonhistone chromosomal) protein 2                                                                 | 283 | 1.00E-75 |
|                          |         |                   |            | 2001363A                                                                                          | high mobility group protein 2                                                                                                   | 283 | 1.00E-75 |
|                          |         |                   |            | XP_086648.2                                                                                       | similar to dJ579F20.1 (high-mobility group (nonhistone chromosomal) protein 1-like 1)                                           | 250 | 7.00E-66 |
|                          |         |                   |            | NP_005333.1                                                                                       | high-mobility group box 3; high-mobility group (nonhistone chromosomal) protein 4                                               | 244 | 4.00E-64 |
|                          |         |                   |            | O15347                                                                                            | HMG4_HUMAN High mobility group protein 4 (HMG-4) (High mobility group protein 2a) (HMG-2a)                                      | 244 | 4.00E-64 |
|                          |         |                   |            | CAA71143.1                                                                                        | high mobility group protein 2a                                                                                                  | 244 | 4.00E-64 |
| NM_013459<br>NP_038487.1 | Mm.4407 | F:(C-IR)<br>-2.13 | P00746     | CFAD_HUMAN Complement factor D precursor (C3 convertase activator) (Properdin factor D) (Adipsin) |                                                                                                                                 | 370 | e-102    |
|                          |         |                   | CAC48304.1 | adipsin/complement factor D precursor                                                             |                                                                                                                                 | 358 | 4.00E-99 |
|                          |         |                   | DBHU       | complement factor D (EC 3.4.21.46) precursor [validated]                                          |                                                                                                                                 | 352 | 5.00E-97 |
|                          |         |                   | 1FDP       | A Chain A, Proenzyme Of Human Complement Factor D, Recombinant Profactor D                        |                                                                                                                                 | 340 | 1.00E-93 |
|                          |         |                   | 1FDP       | B Chain B, Proenzyme Of Human Complement Factor D, Recombinant Profactor D                        |                                                                                                                                 | 340 | 1.00E-93 |
|                          |         |                   | 1FDP       | D Chain D, Proenzyme Of Human Complement Factor D, Recombinant Profactor D                        |                                                                                                                                 | 340 | 1.00E-93 |
|                          |         |                   | 1FDP       | C Chain C, Proenzyme Of Human Complement Factor D, Recombinant Profactor D                        |                                                                                                                                 | 340 | 1.00E-93 |
|                          |         |                   | AAH34529.1 | Unknown (protein for IMAGE:4780594)                                                               |                                                                                                                                 | 340 | 1.00E-93 |
|                          |         |                   | 1DST       | Mutant Of Factor D With Enhanced Catalytic Activity                                               |                                                                                                                                 | 330 | 1.00E-90 |

|             |          |                |  |             |                                                                                                                                           |     |          |
|-------------|----------|----------------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |                |  | IBIO        | Human Complement Factor D In Complex With Isatoic Anhydride Inhibitor                                                                     | 329 | 4.00E-90 |
|             |          |                |  | IDIC        | A Chain A, Structure Of 3,4-Dichloroisocoumarin-Inhibited Factor D                                                                        | 329 | 4.00E-90 |
|             |          |                |  | IDSU        | A Chain A, Human Factor D, Complement Activating Enzyme                                                                                   | 329 | 4.00E-90 |
|             |          |                |  | IHFD        | Human Complement Factor D In A P21 Crystal Form                                                                                           | 329 | 4.00E-90 |
|             |          |                |  | IDFP        | A Chain A, Factor D Inhibited By Diisopropyl Fluorophosphate                                                                              | 329 | 4.00E-90 |
|             |          |                |  | IDFP        | B Chain B, Factor D Inhibited By Diisopropyl Fluorophosphate                                                                              | 329 | 4.00E-90 |
|             |          |                |  | IDSU        | B Chain B, Human Factor D, Complement Activating Enzyme                                                                                   | 329 | 4.00E-90 |
|             |          |                |  | XP_084037.1 | similar to Complement factor D precursor (C3 convertase activator) (Properdin factor D) (Adipsin)                                         | 328 | 8.00E-90 |
|             |          |                |  | NP_001919.1 | adipsin/complement factor D precursor                                                                                                     | 324 | 1.00E-88 |
|             |          |                |  | AAA35527.1  | adipsin/complement factor D                                                                                                               | 324 | 1.00E-88 |
| AK017926    | Mm.21697 | F:(C-D) - 2.38 |  | NP_061931.1 | RTP801                                                                                                                                    | 372 | e-103    |
| BAB31006.1  |          |                |  |             |                                                                                                                                           |     |          |
|             |          |                |  | BAA91214.1  | unnamed protein product                                                                                                                   | 372 | e-103    |
|             |          |                |  | AAH07714.1  | hypothetical protein                                                                                                                      | 372 | e-103    |
|             |          |                |  | AAH15236.1  | hypothetical protein                                                                                                                      | 372 | e-103    |
|             |          |                |  | AAL38424.1  | RTP801                                                                                                                                    | 372 | e-103    |
|             |          |                |  | AAM10442.1  | REDD-1                                                                                                                                    | 372 | e-103    |
|             |          |                |  | CAB66603.1  | hypothetical protein                                                                                                                      | 370 | e-102    |
| NM_007706   | Mm.4132  | F:(C-D) - 2.03 |  | NP_003868.1 | suppressor of cytokine signaling-2; STAT induced STAT inhibitor-2; cytokine-inducible SH2 protein 2                                       | 364 | e-100    |
| NP_031732.1 |          |                |  |             |                                                                                                                                           |     |          |
|             |          |                |  | XP_170547.1 | similar to Suppressor of cytokine signaling 2 (SOCS-2) (Cytokine-inducible SH2 protein 2) (CIS-2) (STAT induced STAT inhibitor 2) (SSI-2) | 364 | e-100    |
|             |          |                |  | O14508      | SOC2_HUMAN Suppressor of cytokine signaling 2 (SOCS-2) (Cytokine-inducible SH2 protein 2) (CIS-2) (STAT induced STAT inhibitor 2) (SSI-2) | 364 | e-100    |
|             |          |                |  | BAA22429.1  | STAT induced STAT inhibitor-2                                                                                                             | 364 | e-100    |
|             |          |                |  | AAC34745.1  | STAT-induced STAT inhibitor-2                                                                                                             | 364 | e-100    |
|             |          |                |  | AAH10399.1  | STAT induced STAT inhibitor-2                                                                                                             | 364 | e-100    |
|             |          |                |  | JC5626      | STAT induced STAT inhibitor 2                                                                                                             | 361 | e-100    |
|             |          |                |  | JC5760      | cytokine-inducible SH2 protein 2                                                                                                          | 360 | 3E-99    |
|             |          |                |  | BAA22536.1  | CIS2                                                                                                                                      | 359 | 4E-99    |

|             |          |                |  |             |                                                                                                                                                      |           |
|-------------|----------|----------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|             |          |                |  | AAC98896.1  | suppressor of cytokine signalling-2; HSSOCS-2                                                                                                        | 350 3E-96 |
| AK017895    | Mm.56339 | F:(C-D) - 2.02 |  | AAC09350.1  | unknown                                                                                                                                              | 317 e-136 |
| XP_132692.1 |          |                |  | XP_057054.6 | similar to SET domain and mariner transposase fusion gene                                                                                            | 317 e-136 |
|             |          |                |  | AAH11635.1  | Similar to SET domain and mariner transposase fusion gene                                                                                            | 317 e-136 |
|             |          |                |  | NP_006506.1 | SET domain and mariner transposase fusion gene                                                                                                       | 313 e-135 |
|             |          |                |  | AAC52012.1  | orf; encodes putative chimeric protein with SET domain in N-terminus with similarity to several other human, Drosophila, nematode and yeast proteins | 313 e-135 |
| NM_011638   | Mm.26069 | F:(C-D) - 2.02 |  | NP_003225.1 | transferrin receptor (p90, CD71); Transferrin receptor                                                                                               | 1196 0    |
| NP_035768.1 |          |                |  |             |                                                                                                                                                      |           |
|             |          |                |  | P02786      | TFR1 HUMAN Transferrin receptor protein 1 (TFR1) (TR) (TfR) (TfRf) (CD71 antigen) (T9) (p90)                                                         | 1196 0    |
|             |          |                |  | JXHU        | transferrin receptor                                                                                                                                 | 1196 0    |
|             |          |                |  | CAA25527.1  | put. transferrin receptor (aa 1-760)                                                                                                                 | 1196 0    |
|             |          |                |  | AAA61153.1  | transferrin receptor                                                                                                                                 | 1196 0    |
|             |          |                |  | I011297A    | transferrin receptor                                                                                                                                 | 1196 0    |
|             |          |                |  | AAF04564.1  | AF187320 1 transferrin receptor                                                                                                                      | 1195 0    |
|             |          |                |  | AAH01188.1  | AAH01188 transferrin receptor (p90, CD71)                                                                                                            | 1195 0    |
|             |          |                |  | IIDE4       | C Chain C, Hemochromatosis Protein Hfe Complexed With Transferrin Receptor                                                                           | 1023 0    |
|             |          |                |  | IIDE4       | F Chain F, Hemochromatosis Protein Hfe Complexed With Transferrin Receptor                                                                           | 1023 0    |
|             |          |                |  | IIDE4       | I Chain I, Hemochromatosis Protein Hfe Complexed With Transferrin Receptor                                                                           | 1023 0    |
|             |          |                |  | ICX8        | A Chain A, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | B Chain B, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | C Chain C, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | D Chain D, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | E Chain E, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | F Chain F, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | G Chain G, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |
|             |          |                |  | ICX8        | H Chain H, Crystal Structure Of The Ectodomain Of Human Transferrin Receptor                                                                         | 1020 0    |

|  |  |  |  |             |                                                                                                                                                                                                                                                                                                                               |              |
|--|--|--|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|  |  |  |  | Q9UP52      | TFR2 HUMAN Transferrin receptor protein 2 (Tfr2)                                                                                                                                                                                                                                                                              | 545 e-154    |
|  |  |  |  | AAD45561.1  | AF067864 1 transferrin receptor 2 alpha                                                                                                                                                                                                                                                                                       | 545 e-154    |
|  |  |  |  | NP_003218.1 | transferrin receptor 2                                                                                                                                                                                                                                                                                                        | 498 e-140    |
|  |  |  |  | AAC78796.1  | transferrin-receptor2                                                                                                                                                                                                                                                                                                         | 498 e-140    |
|  |  |  |  | BAA91153.1  | unnamed protein product                                                                                                                                                                                                                                                                                                       | 315 2.00E-85 |
|  |  |  |  | AAC83972.1  | prostate-specific membrane antigen                                                                                                                                                                                                                                                                                            | 228 2.00E-59 |
|  |  |  |  | NP_004467.1 | folate hydrolase (prostate-specific membrane antigen) 1; folate hydrolase 1 (prostate-specific membrane antigen)                                                                                                                                                                                                              | 228 3.00E-59 |
|  |  |  |  | Q04609      | FOH1_HUMAN Glutamate carboxypeptidase II (Membrane glutamate carboxypeptidase) (mGCP) (N-acetylated-alpha-linked acidic dipeptidase I) (NAALADase I) (Pteroylpoly-gamma-glutamate carboxypeptidase) (Folypoly-gamma-glutamate carboxypeptidase) (FGCP) (Folate hydrolase 1) (Prostate-specific membrane antigen) (PSMA) (PSM) | 228 3.00E-59 |
|  |  |  |  | A56881      | prostate-specific membrane antigen                                                                                                                                                                                                                                                                                            | 228 3.00E-59 |
|  |  |  |  | AAA60209.1  | prostate-specific membrane antigen                                                                                                                                                                                                                                                                                            | 228 3.00E-59 |
|  |  |  |  | AAD51121.1  | AF176574 1 folypoly-gamma-glutamate carboxypeptidase                                                                                                                                                                                                                                                                          | 228 3.00E-59 |
|  |  |  |  | AAM34479.1  | prostate-specific membrane antigen                                                                                                                                                                                                                                                                                            | 228 3.00E-59 |
|  |  |  |  | XP_165392.1 | similar to folate hydrolase (prostate-specific membrane antigen) 1; folate hydrolase 1 (prostate-specific membrane antigen)                                                                                                                                                                                                   | 224 6.00E-58 |

**Subtable 1B: Unfavorable Genes and Proteins**

| Mouse Gene Protein | Unigene | Behavior        | Human Proteins | Human Protein Name                                                                                         | Score (bits) | E-value  |
|--------------------|---------|-----------------|----------------|------------------------------------------------------------------------------------------------------------|--------------|----------|
| NM_007588          |         |                 |                |                                                                                                            |              |          |
| NP_031614.1        | Mm.4642 | U:(IR-D)<br>3.8 | AAC50300.1     | calcitonin receptor                                                                                        | 758          | 0        |
|                    |         |                 | BAA86929.1     | calcitonin receptor                                                                                        | 758          | 0        |
|                    |         |                 | BAA86928.1     | calcitonin receptor                                                                                        | 758          | 0        |
|                    |         |                 | NP_001733.1    | calcitonin receptor                                                                                        | 754          | 0        |
|                    |         |                 | I37217         | calcitonin receptor                                                                                        | 754          | 0        |
|                    |         |                 | CAA49541.1     | human calcitonin receptor                                                                                  | 754          | 0        |
|                    |         |                 | CAA57849.1     | truncated isomer of calcitonin receptor                                                                    | 754          | 0        |
|                    |         |                 | AAB83945.1     | Calcitonin Receptor, alternatively spliced form                                                            | 754          | 0        |
|                    |         |                 | P30988         | CALR_HUMAN Calcitonin receptor precursor (CT-R)                                                            | 748          | 0        |
|                    |         |                 | S34486         | calcitonin receptor                                                                                        | 748          | 0        |
|                    |         |                 | AAA35640.1     | calcitonin receptor                                                                                        | 748          | 0        |
|                    |         |                 | AAB83944.1     | Calcitonin Receptor, alternatively spliced form                                                            | 744          | 0        |
|                    |         |                 | AAC50301.1     | calcitonin receptor isoform                                                                                | 731          | 0        |
|                    |         |                 | NP_005786.1    | calcitonin receptor-like                                                                                   | 511          | e-144    |
|                    |         |                 | Q16602         | CGRR_HUMAN Calcitonin gene-related peptide type 1 receptor precursor (CGRP type 1 receptor)                | 511          | e-144    |
|                    |         |                 | JC2477         | calcitonin receptor-like protein                                                                           | 511          | e-144    |
|                    |         |                 | AAA62158.1     | calcitonin-like receptor                                                                                   | 511          | e-144    |
|                    |         |                 | AAC41994.1     | CGRP type 1 receptor                                                                                       | 511          | e-144    |
|                    |         |                 | NP_000307.1    | parathyroid hormone receptor 1                                                                             | 237          | 1.00e-61 |
|                    |         |                 | Q03431         | PTRR_HUMAN Parathyroid hormone/parathyroid hormone-related peptide receptor precursor (PTH/PTHrP receptor) | 237          | 1.00e-61 |

|            |          |               |             |                                                                                                                                        |     |          |
|------------|----------|---------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|            |          |               | A49191      | parathyroid hormone/PTH-related peptide receptor                                                                                       | 237 | 1.00e-61 |
|            |          |               | AAA36525.1  | parathyroid hormone receptor                                                                                                           | 237 | 1.00e-61 |
|            |          |               | CAA48589.1  | parathyroid hormone receptor                                                                                                           | 237 | 1.00e-61 |
|            |          |               | AAA56774.1  | parathyroid hormone/parathyroid hormone related peptide receptor                                                                       | 237 | 1.00e-61 |
|            |          |               | AAB60657.1  | parathyroid hormone/PTH-related peptide receptor                                                                                       | 237 | 1.00e-61 |
|            |          |               | 2119172A    | parathyrin receptor                                                                                                                    | 237 | 1.00e-61 |
|            |          |               | Q13324      | CRF2_HUMAN Corticotropin releasing factor receptor 2 precursor (CRF-R 2) (CRF2) (Corticotropin-releasing hormone receptor 2) (CRH-R 2) | 221 | 6.00e-57 |
|            |          |               | AAC71653.1  | corticotropin-releasing factor receptor                                                                                                | 221 | 6.00e-57 |
|            |          |               | BAC05922.1  | seven transmembrane helix receptor                                                                                                     | 221 | 6.00e-57 |
|            |          |               | AAB94503.1  | corticotropin releasing hormone receptor type 2 beta isoform                                                                           | 221 | 8.00e-57 |
|            |          |               | AAB94562.1  | corticotropin releasing hormone receptor type 2 gamma isoform; CRH type 2 gamma receptor                                               | 220 | 1.00e-56 |
|            |          |               | AAC71654.1  | corticotropin releasing hormone receptor type 2 gamma isoform; match to AF019381 (PID:g2738889)                                        | 220 | 1.00e-56 |
| AK007657   |          |               |             |                                                                                                                                        |     |          |
| BAB25167.1 | Mm.45138 | U:(IR-D) 3.55 | NP_115744.2 | leucine zipper and CTNNBIP1 domain containing                                                                                          | 305 | 9.00e-83 |
|            |          |               | BAB72100.1  | Leucine zipper & ICAT homologous protein LZIC                                                                                          | 305 | 9.00e-83 |
| AK007999   |          |               |             |                                                                                                                                        |     |          |
| BAB25399.1 | Mm.35718 | U:(IR-D) 3.3  | XP_114275.1 | similar to RIKEN cDNA 2010001C09                                                                                                       | 244 | 1.00e-64 |
| AF282730   |          |               |             |                                                                                                                                        |     |          |
| AAF97239.1 | Mm.36851 | U:(IR-D) 2.78 | NP_003247.1 | tissue inhibitor of metalloproteinase 4 precursor                                                                                      | 409 | e-114    |
|            |          |               | Q99727      | TIM4_HUMAN Metalloproteinase inhibitor 4 precursor (TIMP-4) (Tissue inhibitor of metalloproteinases-4)                                 | 409 | e-114    |
|            |          |               | AAB40391.1  | tissue inhibitor of metalloproteinase 4                                                                                                | 409 | e-114    |
|            |          |               | AAC34422.1  | tissue inhibitor of metalloproteinase 4                                                                                                | 409 | e-114    |
|            |          |               | AAH10553.1  | AAH10553 tissue inhibitor of metalloproteinase 4                                                                                       | 409 | e-114    |

|  |  |  |  |             |                                                                                                                          |     |          |
|--|--|--|--|-------------|--------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  |  | NP 003246.1 | tissue inhibitor of metalloproteinase 2 precursor                                                                        | 216 | 3.00e-56 |
|  |  |  |  | P16035      | TIM2_HUMAN Metalloproteinase inhibitor 2 precursor (TIMP-2) (Tissue inhibitor of metalloproteinases-2) (CSC-21K)         | 216 | 3.00e-56 |
|  |  |  |  | A37128      | metalloproteinase inhibitor 2 precursor                                                                                  | 216 | 3.00e-56 |
|  |  |  |  | AAB19474.1  | tissue inhibitor of metalloproteinase 2; TIMP-2                                                                          | 216 | 3.00e-56 |
|  |  |  |  | AAA59581.1  | metalloproteinase inhibitor precursor                                                                                    | 216 | 3.00e-56 |
|  |  |  |  | AAA61186.1  | metalloproteinase-2 inhibitor precursor                                                                                  | 216 | 3.00e-56 |
|  |  |  |  | AAC50729.1  | tissue inhibitor of metalloproteinases-2                                                                                 | 216 | 3.00e-56 |
|  |  |  |  | 1GXD        | C Chain C, Prommp-2TIMP-2 Complex                                                                                        | 214 | 1.00e-55 |
|  |  |  |  | 1GXD        | D Chain D, Prommp-2TIMP-2 Complex                                                                                        | 214 | 1.00e-55 |
|  |  |  |  | 1BR9        | Human Tissue Inhibitor Of Metalloproteinase-2                                                                            | 214 | 1.00e-55 |
|  |  |  |  | AAB24785.1  | TIMP-2, CSC-21K=tissue inhibitor of metalloproteinase                                                                    | 211 | 9.00e-55 |
|  |  |  |  | AAA21815.1  | metalloproteinase-3 tissue inhibitor                                                                                     | 200 | 3.00e-51 |
|  |  |  |  | NP 000353.1 | tissue inhibitor of metalloproteinase 3; Tissue inhibitor of metalloproteinase-3; K222 expressed in degenerative retinas | 199 | 4.00e-51 |
|  |  |  |  | P35625      | TIM3_HUMAN Metalloproteinase inhibitor 3 precursor (TIMP-3) (Tissue inhibitor of metalloproteinases-3) (MIG-5 protein)   | 199 | 4.00e-51 |
|  |  |  |  | S45317      | metalloproteinase inhibitor 3 precursor                                                                                  | 199 | 4.00e-51 |
|  |  |  |  | AAA17672.1  | tissue inhibitor of metalloproteinase-3 precursor                                                                        | 199 | 4.00e-51 |
|  |  |  |  | CAA53813.1  | tissue inhibitor of metalloproteinases-3                                                                                 | 199 | 4.00e-51 |
|  |  |  |  | AAB60373.1  | tissue inhibitor of metalloproteinases-3                                                                                 | 199 | 4.00e-51 |
|  |  |  |  | AAB34532.1  | TIMP-3                                                                                                                   | 199 | 4.00e-51 |
|  |  |  |  | AAC50393.1  | tissue inhibitor of metalloproteinases-3                                                                                 | 199 | 4.00e-51 |
|  |  |  |  | AAB07547.1  | tissue inhibitor of metalloproteinase-3                                                                                  | 199 | 4.00e-51 |
|  |  |  |  | AAH14277.1  | AAH14277 Similar to tissue inhibitor of metalloproteinase 3 (Sorsby fundus dystrophy, pseudoinflammatory)                | 199 | 4.00e-51 |
|  |  |  |  | CAA38400.1  | Tissue inhibitor of metalloproteinases, Type-2                                                                           | 199 | 6.00e-51 |





|             |         |          |  |             |                                                                                                                                  |      |       |
|-------------|---------|----------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------|------|-------|
|             |         |          |  | CAA53705.1  | DNA binding protein RFX2                                                                                                         | 1153 | 0     |
|             |         |          |  | NP_000626.2 | regulatory factor X2, isoform a; trans-acting regulatory factor 2; DNA binding protein RFX2; HLA class II regulatory factor RFX2 | 1152 | 0     |
|             |         |          |  | AAH28579.1  | regulatory factor X, 2 (influences HLA class II expression)                                                                      | 1151 | 0     |
|             |         |          |  | NP_602304.1 | regulatory factor X3 isoform b; DNA binding protein RFX3                                                                         | 773  | 0     |
|             |         |          |  | AAH22191.1  | AAH22191 Unknown (protein for MGC:3664)                                                                                          | 773  | 0     |
|             |         |          |  | NP_002910.1 | regulatory factor X3 isoform a; DNA binding protein RFX3                                                                         | 751  | 0     |
|             |         |          |  | P48380      | RFX3_HUMAN DNA-binding protein RFX3                                                                                              | 751  | 0     |
|             |         |          |  | D55926      | DNA binding protein RFX3                                                                                                         | 751  | 0     |
|             |         |          |  | CAA53706.1  | DNA binding protein RFX3                                                                                                         | 751  | 0     |
|             |         |          |  | P22670      | RFX1_HUMAN MHC class II regulatory factor RFX1 (RFX) (Enhancer factor C) (EF-C)                                                  | 686  | 0     |
|             |         |          |  | A35913      | regulatory factor X                                                                                                              | 686  | 0     |
|             |         |          |  | CAA41730.1  | MHC class II regulatory factor RFX                                                                                               | 686  | 0     |
|             |         |          |  | NP_002909.2 | regulatory factor X1; trans-acting regulatory factor 1; enhancer factor C; MHC class II regulatory factor RFX                    | 686  | 0     |
|             |         |          |  | CAC88163.1  | bA32F11.1.2 (regulatory factor X, 3 (influences HLA class II expression), putative isoform 2)                                    | 507  | e-143 |
|             |         |          |  | CAC88164.1  | bA32F11.1.1 (regulatory factor X, 3 (influences HLA class II expression), isoform 1)                                             | 486  | e-136 |
| NM_026346   | Mm.4046 | U:(IR-D) |  | NP_478136.1 | F-box only protein 32 isoform 1; muscle atrophy F-box protein; atrogin-1                                                         | 710  | 0     |
| NP_080622.1 | 6       | 2.28     |  | Q969P5      | FX32_HUMAN F-box only protein 32 (Muscle atrophy F-box protein) (MAFbx) (Atrogin-1)                                              | 710  | 0     |
|             |         |          |  | AAL16407.1  | muscle atrophy F-box protein                                                                                                     | 710  | 0     |
|             |         |          |  | BAB71333.1  | unnamed protein product                                                                                                          | 710  | 0     |
|             |         |          |  | CAD12251.1  | F-box only 32                                                                                                                    | 710  | 0     |
|             |         |          |  | BAB85128.1  | F-box domain Fbx25-containing protein                                                                                            | 446  | e-124 |
|             |         |          |  | NP_680482.1 | F-box only protein 32 isoform 2; muscle atrophy F-box protein; atrogin-1                                                         | 422  | e-117 |

|             |               |                  |  |             |                                                                                                                                                                                                       |      |          |
|-------------|---------------|------------------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |               |                  |  | AAH24030.1  | similar to RIKEN cDNA 4833442G10 gene                                                                                                                                                                 | 417  | e-116    |
|             |               |                  |  | AAF04526.1  | AF174605 1 F-box protein Fbx25                                                                                                                                                                        | 354  | 4.00e-97 |
|             |               |                  |  | NP_036305.1 | F-box only protein 25; F-box protein Fbx25                                                                                                                                                            | 353  | 6.00e-97 |
| NM_009244   |               |                  |  |             |                                                                                                                                                                                                       |      |          |
| NP_033270.1 | Mm.19341<br>8 | U:(IR-D)<br>2.26 |  | AAA51547.1  | alpha-1-antitrypsin precursor                                                                                                                                                                         | 508  | e-144    |
|             |               |                  |  | AAH15642.1  | AAH15642 Similar to serine (or cysteine) proteinase inhibitor, clade A (alpha-1 antiprotease, antitrypsin), member 1                                                                                  | 508  | e-144    |
|             |               |                  |  | 1012287A    | antitrypsin alpha1 mutant                                                                                                                                                                             | 507  | e-143    |
|             |               |                  |  | P01009      | A1AT_HUMAN Alpha-1-antitrypsin precursor (Alpha-1 protease inhibitor) (Alpha-1-antiprotease) (PRO0684/PRO2209)                                                                                        | 507  | e-143    |
|             |               |                  |  | ITHU        | alpha-1-antitrypsin precursor [validated]                                                                                                                                                             | 507  | e-143    |
|             |               |                  |  | CAA25838.1  | alpha 1-antitrypsin                                                                                                                                                                                   | 507  | e-143    |
|             |               |                  |  | AAB59375.1  | alpha-1-antitrypsin                                                                                                                                                                                   | 507  | e-143    |
|             |               |                  |  | AAG35496.1  | AF130117 27 PRO2209                                                                                                                                                                                   | 507  | e-143    |
|             |               |                  |  |             | serine (or cysteine) proteinase inhibitor, clade A (alpha-1 antiprotease, antitrypsin), member 1; Protease inhibitor (alpha-1-antitrypsin); protease inhibitor 1 (anti-elastase), alpha-1-antitrypsin | 506  | e-143    |
|             |               |                  |  | NP_000286.2 |                                                                                                                                                                                                       |      |          |
|             |               |                  |  | AAH11991.1  | AAH11991 Similar to serine (or cysteine) proteinase inhibitor, clade A (alpha-1 antiprotease, antitrypsin), member 1                                                                                  | 506  | e-143    |
|             |               |                  |  | AAF29581.1  | AF113676 1 PRO0684                                                                                                                                                                                    | 504  | e-142    |
|             |               |                  |  | AAB59495.1  | alpha-1-antitrypsin                                                                                                                                                                                   | 504  | e-142    |
|             |               |                  |  | AAA51546.1  | alpha-1-antitrypsin                                                                                                                                                                                   | 501  | e-141    |
|             |               |                  |  | 1HP7        | Chain A, A 2.1 Angstrom Structure Of An Uncleaved Alpha-1- Antitrypsin Shows Variability Of The Reactive Center And Other Loops                                                                       | 499  | e-141    |
|             |               |                  |  | 1KCT        | Alpha 1-Antitrypsin                                                                                                                                                                                   | 498  | e-141    |
| NM_009194   |               |                  |  |             |                                                                                                                                                                                                       |      |          |
| NP_033220.1 | Mm.4168       | U:(IR-D)<br>2.16 |  | NP_001037.1 | solute carrier family 12 (sodium/potassium/chloride transporters), member 2; Solute carrier family 12 (sodium/potassium/chloride transporters),                                                       | 1978 | 0        |

|             |         |               |  |             |                                                                                                                                                     |      |          |
|-------------|---------|---------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |               |  | P55011      | S122_HUMAN Solute carrier family 12 member 2 (Bumetanide-sensitive sodium-(potassium)-chloride cotransporter 1) (Basolateral Na-K-Cl symporter)     | 1978 | 0        |
|             |         |               |  | A57187      | bumetanide-sensitive Na-K-Cl cotransporter                                                                                                          | 1978 | 0        |
|             |         |               |  | AAC 0561.1  | bumetanide-sensitive Na-K-Cl cotransporter                                                                                                          | 1978 | 0        |
|             |         |               |  | AAH33003.1  | Similar to solute carrier family 12 (sodium/potassium/chloride transporters), member 2                                                              | 1851 | 0        |
|             |         |               |  | NP_000329.1 | sodium potassium chloride cotransporter 2; Solute carrier family 12 (sodium/potassium/chloride transporters),                                       | 1294 | 0        |
|             |         |               |  | Q13621      | S121_HUMAN Solute carrier family 12 member 1 (Bumetanide-sensitive sodium-(potassium)-chloride cotransporter 2) (Kidney-specific Na-K-Cl symporter) | 1294 | 0        |
|             |         |               |  | AAB07364.1  | bumetanide-sensitive Na-K-2Cl cotransporter                                                                                                         | 1294 | 0        |
|             |         |               |  | NP_000330.1 | solute carrier family 12 (sodium/chloride transporters), member 3; Solute carrier family 12 (sodium/potassium/chloride transporters)                | 1028 | 0        |
|             |         |               |  | AAC50355.1  | thiazide-sensitive Na-Cl                                                                                                                            | 1028 | 0        |
|             |         |               |  | P55017      | S123_HUMAN Solute carrier family 12 member 3 (Thiazide-sensitive sodium-chloride cotransporter) (Na-Cl symporter)                                   | 1024 | 0        |
|             |         |               |  | G01202      | NaCl electroneutral Thiazide-sensitive cotransporter                                                                                                | 1021 | 0        |
|             |         |               |  | CAA62613.1  | NaCl electroneutral Thiazide-sensitive cotransporter                                                                                                | 1021 | 0        |
|             |         |               |  | AAL32454.1  | AF439152_1 sodium-potassium-chloride cotransporter                                                                                                  | 598  | e-170    |
|             |         |               |  | PC4180      | thiazide-sensitive sodium-chloride cotransporter                                                                                                    | 413  | e-114    |
|             |         |               |  | AAH40138.1  | Similar to solute carrier family 12 (sodium/potassium/chloride                                                                                      | 403  | e-111    |
|             |         |               |  | AAK21008.1  | cation-chloride cotransporter-interacting protein 1                                                                                                 | 261  | 1.00e-68 |
| NM_009254   |         |               |  |             | serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 6; protease inhibitor 6 (placental thrombin inhibitor)                       |      |          |
| NP_033280.1 | Mm.2623 | U:(IR-D) 2.15 |  | NP_004559.2 | PT16_HUMAN Placental thrombin inhibitor (Cytoplasmic antiprotease)                                                                                  | 549  | e-156    |
|             |         |               |  | P35237      | (CAP)(Protease inhibitor 6) (PI-6)                                                                                                                  | 549  | e-156    |
|             |         |               |  | AAB30320.1  | cytoplasmic antiprotease; CAP                                                                                                                       | 549  | e-156    |

|  |  |  |  |             |                                                                                                                                                                                                        |     |          |
|--|--|--|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  |  | AAH01394.1  | AAH01394 serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 6                                                                                                                      | 549 | e-156    |
|  |  |  |  | A48681      | placental thrombin inhibitor                                                                                                                                                                           | 548 | e-156    |
|  |  |  |  | CAA80373.1  | thrombin inhibitor                                                                                                                                                                                     | 548 | e-156    |
|  |  |  |  | NP_002631.1 | serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 8; protease inhibitor 8 (ovalbumin type)                                                                                        | 459 | e-129    |
|  |  |  |  | P50452      | SPB8_HUMAN Cytoplasmic antiprotease 2 (CAP2) (CAP-2) (Protease inhibitor 8)(Serpine B8)                                                                                                                | 459 | e-129    |
|  |  |  |  | A59273      | protease inhibitor 8                                                                                                                                                                                   | 459 | e-129    |
|  |  |  |  | AAC41939.1  | cytoplasmic antiprotease 2                                                                                                                                                                             | 459 | e-129    |
|  |  |  |  | NP_004146.1 | serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 9; protease inhibitor 9 (ovalbumin type)                                                                                        | 445 | e-125    |
|  |  |  |  | P50453      | SPB9_HUMAN Cytoplasmic antiprotease 3 (CAP3) (CAP-3) (Protease inhibitor 9)(Serpine B9)                                                                                                                | 445 | e-125    |
|  |  |  |  | B59273      | protease inhibitor 9                                                                                                                                                                                   | 445 | e-125    |
|  |  |  |  | AAC41940.1  | cytoplasmic antiprotease 3                                                                                                                                                                             | 445 | e-125    |
|  |  |  |  | AAC50793.1  | serine proteinase inhibitor                                                                                                                                                                            | 445 | e-125    |
|  |  |  |  | AAH02538.1  | AAH02538 serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 9                                                                                                                      | 445 | e-125    |
|  |  |  |  | BAB91078.1  | serine protease inhibitor 9                                                                                                                                                                            | 445 | e-125    |
|  |  |  |  | NP_109591.1 | serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 1; protease inhibitor 2 (anti-elastase), monocyte/neutrophil; protease inhibitor 2 (anti-elastase), monocyte/neutrophil derived | 330 | 3.00e-90 |
|  |  |  |  | P30740      | ILEU_HUMAN Leukocyte elastase inhibitor (LEI) (Monocyte/neutrophil elastase inhibitor) (M/NEI) (EI)                                                                                                    | 330 | 3.00e-90 |
|  |  |  |  | S27383      | elastase inhibitor                                                                                                                                                                                     | 330 | 3.00e-90 |
|  |  |  |  | AAC31394.1  | monocyte/neutrophil elastase inhibitor                                                                                                                                                                 | 330 | 3.00e-90 |
|  |  |  |  | AAH09015.1  | AAH09015 serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 1                                                                                                                      | 330 | 3.00e-90 |
|  |  |  |  | XP_036951.4 | similar to Squamous cell carcinoma antigen 2 (SCCA-2) (Leupin)                                                                                                                                         | 327 | 2.00e-89 |
|  |  |  |  | P48594      | SCC2_HUMAN Squamous cell carcinoma antigen 2 (SCCA-2) (Leupin)                                                                                                                                         | 327 | 2.00e-89 |

|                          |               |                  |             |                                                                                                                       |  |     |          |
|--------------------------|---------------|------------------|-------------|-----------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|                          |               |                  | CAA61420.1  | leupin                                                                                                                |  | 327 | 2.00e-89 |
|                          |               |                  | AAA97553.1  | squamous cell carcinoma antigen 2                                                                                     |  | 327 | 2.00e-89 |
|                          |               |                  | AAA92602.1  | squamous cell carcinoma antigen                                                                                       |  | 327 | 2.00e-89 |
|                          |               |                  | BAB21525.1  | squamous cell carcinoma antigen 2                                                                                     |  | 327 | 2.00e-89 |
|                          |               |                  | AAH17401.1  | AAH17401 Unknown (protein for MGC:27150)                                                                              |  | 327 | 2.00e-89 |
|                          |               |                  | I38202      | leupin precursor                                                                                                      |  | 327 | 2.00e-89 |
|                          |               |                  | I38201      | squamous cell carcinoma antigen 1                                                                                     |  | 325 | 7.00e-89 |
|                          |               |                  | NP_008850.1 | serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 3; squamous cell carcinoma antigen 1           |  | 325 | 9.00e-89 |
|                          |               |                  | P29508      | SCC1_HUMAN Squamous cell carcinoma antigen 1 (SCCA-1) (Protein T4-A)                                                  |  | 325 | 9.00e-89 |
|                          |               |                  | AAA86317.1  | squamous cell carcinoma antigen                                                                                       |  | 325 | 9.00e-89 |
|                          |               |                  | AAA97552.1  | squamous cell carcinoma antigen 1                                                                                     |  | 325 | 9.00e-89 |
|                          |               |                  | AAH05224.1  | AAH05224 serine (or cysteine) proteinase inhibitor, clade B (ovalbumin), member 3                                     |  | 325 | 9.00e-89 |
|                          |               |                  | AAB20405.1  | squamous cell carcinoma antigen; SCC antigen                                                                          |  | 325 | 9.00e-89 |
| NM_019431<br>NP_062304.1 | Mm.1037<br>24 | U:(IR-D)<br>2.09 | NP_055220.1 | voltage-dependent calcium channel gamma-4 subunit; neuronal voltage-gated calcium channel gamma-4 subunit             |  | 540 | e-153    |
|                          |               |                  | Q9UBN1      | CCG4_HUMAN Voltage-dependent calcium channel gamma-4 subunit (Neuronal voltage-gated calcium channel gamma-4 subunit) |  | 540 | e-153    |
|                          |               |                  | AAF03090.1  | calcium channel gamma 4 subunit                                                                                       |  | 540 | e-153    |
|                          |               |                  | AAF14538.1  | AF162692_1 putative voltage-gated calcium channel gamma-4 subunit                                                     |  | 540 | e-153    |
|                          |               |                  | AAH34532.1  | calcium channel, voltage-dependent, gamma subunit 4                                                                   |  | 540 | e-153    |
|                          |               |                  | NP_006069.1 | voltage-dependent calcium channel gamma-2 subunit; stargazin; neuronal voltage-gated calcium channel gamma-2 subunit  |  | 303 | 2.00e-82 |
|                          |               |                  | Q9Y698      | CCG2_HUMAN Voltage-dependent calcium channel gamma-2 subunit (Neuronal voltage-gated calcium channel gamma-2 subunit) |  | 303 | 2.00e-82 |
|                          |               |                  | AAD22738.1  | AF096322_1 neuronal voltage-gated calcium channel gamma-2 subunit                                                     |  | 303 | 2.00e-82 |
|                          |               |                  | AAL50049.1  | AF361354_1 voltage-dependent calcium channel gamma-8 subunit                                                          |  | 302 | 4.00e-82 |

|                          |               |                  |  |             |                                                                                                                       |     |          |
|--------------------------|---------------|------------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |               |                  |  | NP_114101.4 | voltage-dependent calcium channel gamma-8 subunit; neuronal voltage-gated calcium channel gamma-8 subunit             | 300 | 2.00e-81 |
|                          |               |                  |  | Q8WXS5      | CCG8_HUMAN Voltage-dependent calcium channel gamma-8 subunit (Neuronal voltage-gated calcium channel gamma-8 subunit) | 300 | 2.00e-81 |
|                          |               |                  |  | AAK20031.1  | AF288388_1 calcium channel gamma subunit 8                                                                            | 300 | 2.00e-81 |
|                          |               |                  |  | NP_006530.1 | voltage-dependent calcium channel gamma-3 subunit; neuronal voltage-gated calcium channel gamma-3 subunit             | 298 | 8.00e-81 |
|                          |               |                  |  | O60359      | CCG3_HUMAN Voltage-dependent calcium channel gamma-3 subunit (Neuronal voltage-gated calcium channel gamma-3 subunit) | 298 | 8.00e-81 |
|                          |               |                  |  | AAC15246.1  | Unknown gene product                                                                                                  | 298 | 8.00e-81 |
|                          |               |                  |  | AAD22739.1  | AF100346_1 neuronal voltage gated calcium channel gamma-3 subunit                                                     | 298 | 8.00e-81 |
|                          |               |                  |  | AAF42975.1  | AF134640_1 calcium channel gamma subunit 3                                                                            | 298 | 8.00e-81 |
|                          |               |                  |  | AAH40005.1  | calcium channel, voltage-dependent, gamma subunit 3                                                                   | 298 | 8.00e-81 |
|                          |               |                  |  | XP_050231.1 | similar to calcium channel gamma subunit 8                                                                            | 270 | 2.00e-72 |
|                          |               |                  |  | AAK15019.1  | AF234892_1 putative voltage gated calcium channel gamma-8 subunit CACNG8                                              |     |          |
| NM_019999<br>NP_064383.1 | Mm.1772<br>72 | U:(IR-D)<br>2.05 |  | NP_072094.1 | KIAA1184 protein                                                                                                      | 659 | 0        |
|                          |               |                  |  | AAH02937.1  | AAH02937 Similar to hypothetical protein MNCb-5687                                                                    | 659 | 0        |
|                          |               |                  |  | BAA86498.1  | KIAA1184 protein                                                                                                      | 579 | e-165    |
|                          |               |                  |  | AAH36457.1  | Unknown (protein for MGC:33461)                                                                                       | 579 | e-165    |
|                          |               |                  |  |             |                                                                                                                       |     |          |
|                          |               |                  |  |             |                                                                                                                       |     |          |
|                          |               |                  |  |             |                                                                                                                       |     |          |
| AK002297                 |               |                  |  |             |                                                                                                                       |     |          |
| BAB21996.1               | Mm.18130<br>2 | U:(C-IR)<br>6.3  |  | NP_060464.1 | hypothetical protein FLJ10099                                                                                         |     |          |
|                          |               |                  |  | BAA91444.1  | unnamed protein product                                                                                               | 620 | e-177    |
|                          |               |                  |  | AAH08675.1  | hypothetical protein FLJ10099                                                                                         | 620 | e-177    |

|             |         |                  |  |             |                                                                                                          |      |       |
|-------------|---------|------------------|--|-------------|----------------------------------------------------------------------------------------------------------|------|-------|
|             |         |                  |  | AAH12562.1  | Similar to hypothetical protein FLJ10099                                                                 | 620  | e-177 |
|             |         |                  |  | AAH10519.1  | Similar to hypothetical protein FLJ10099                                                                 | 385  | e-106 |
| NM_013744   | Mm.7467 | U:(C-IR)<br>6.11 |  | NP_478137.1 | zinc finger protein 354B                                                                                 | 1031 | 0     |
| NP_038772.1 | 0       | U:(IR-D)<br>2.04 |  |             |                                                                                                          |      |       |
|             |         |                  |  | BAB71556.1  | unnamed protein product                                                                                  | 1031 | 0     |
|             |         |                  |  | AAD05335.1  | zinc finger protein EZNF                                                                                 | 958  | 0     |
|             |         |                  |  | NP_005640.1 | transcription factor 17                                                                                  | 957  | 0     |
|             |         |                  |  | O60765      | TC17_HUMAN Transcription factor 17 (Zinc finger protein eZNF)                                            | 957  | 0     |
|             |         |                  |  | BAA25182.1  | HKL1                                                                                                     | 957  | 0     |
|             |         |                  |  | NP_009080.1 | zinc finger protein 184 (Kruppel-like)                                                                   | 567  | e-161 |
|             |         |                  |  | AAH22992.1  | Unknown (protein for MGC:29879)                                                                          | 567  | e-161 |
|             |         |                  |  | AAC51180.1  | kruppel-related zinc finger protein                                                                      | 567  | e-161 |
|             |         |                  |  | XP_166367.1 | similar to Zinc finger protein 184                                                                       | 566  | e-161 |
|             |         |                  |  | Q99676      | Z184_HUMAN Zinc finger protein 184                                                                       | 566  | e-161 |
|             |         |                  |  | CAA17278.1  | b3418.1 (zinc finger protein 184 (Kruppel-like))                                                         | 566  | e-161 |
|             |         |                  |  | XP_032054.2 | similar to EZFIT-related protein 1                                                                       | 536  | e-152 |
|             |         |                  |  | AAK30252.1  | AF352026_1 EZFIT-related protein 1                                                                       | 536  | e-152 |
|             |         |                  |  | CAD38551.1  | hypothetical protein                                                                                     | 536  | e-152 |
|             |         |                  |  | XP_091988.1 | similar to zinc finger protein 91 (HPF7, HTF10)                                                          | 533  | e-151 |
|             |         |                  |  | AAH36110.1  | Similar to zinc finger protein 208                                                                       | 531  | e-150 |
| NM_018764   | Mm.1196 | U:(C-IR)<br>4.56 |  | NP_002580.2 | protocadherin 7, isoform a precursor; BH-pcdh; BH-protocadherin (brain-heart); brain-heart protocadherin | 1856 | 0     |
| NP_061234.1 | 4       |                  |  |             |                                                                                                          |      |       |
|             |         |                  |  | O60245      | PCH7_HUMAN Protocadherin 7 precursor (Brain-heart protocadherin) (BH-Pcdh)                               | 1855 | 0     |
|             |         |                  |  | BAA25194.1  | PCDH7 (BH-Pcdh)a                                                                                         | 1855 | 0     |
|             |         |                  |  | NP_115832.1 | protocadherin 7, isoform b precursor; BH-pcdh; brain-heart protocadherin; BH-protocadherin (brain-heart) | 1838 | 0     |



|             |  |               |                  |             |                                                                                                          |      |          |
|-------------|--|---------------|------------------|-------------|----------------------------------------------------------------------------------------------------------|------|----------|
|             |  |               |                  | T00041      | BH-protocadherin PCDH7 (clone BH-Pcdh-b)                                                                 | 1837 | 0        |
|             |  |               |                  | BAA25195.1  | PCDH7 (BH-Pcdh)b                                                                                         | 1837 | 0        |
|             |  |               |                  | NP_115833.1 | protocadherin 7, isoform c precursor; BH-pcdh; brain-heart protocadherin; BH-protocadherin (brain-heart) | 1691 | 0        |
|             |  |               |                  | T00042      | BH-protocadherin PCDH7 (clone BH-Pcdh-c)                                                                 | 1690 | 0        |
|             |  |               |                  | BAA25196.1  | PCDH7 (BH-Pcdh)c                                                                                         | 1690 | 0        |
|             |  |               |                  | NP_115796.1 | protocadherin 1, isoform 2 precursor; protocadherin 42; cadherin-like protein 1                          | 817  | 0        |
|             |  |               |                  | AAH35812.1  | Similar to protocadherin 1 (cadherin-like 1)                                                             | 816  | 0        |
|             |  |               |                  | NP_002578.1 | protocadherin 1, isoform 1 precursor; protocadherin 42; cadherin-like protein 1                          | 816  | 0        |
|             |  |               |                  | Q08174      | PCH1_HUMAN Protocadherin 1 precursor (Protocadherin 42) (PC42) (Cadherin-like protein 1)                 | 816  | 0        |
|             |  |               |                  | AAA36419.1  | protocadherin 42                                                                                         | 816  | 0        |
|             |  |               |                  | NP_065136.1 | protocadherin 9 precursor; cadherin superfamily protein VR4-11                                           | 575  | e-163    |
|             |  |               |                  | AAF89689.2  | AF169692_1 protocadherin-9                                                                               | 575  | e-163    |
| NM_008121   |  |               | U:(C-IR)<br>4.51 |             |                                                                                                          |      |          |
| NP_032147.1 |  | Mm.19038<br>6 | U:(C-D)<br>2.06  | NP_005257.2 | gap junction protein, alpha 5, 40kDa (connexin 40); gap junction protein, alpha 5, 40kD (connexin 40)    | 580  | e-165    |
|             |  |               |                  | P36382      | CXA5_HUMAN Gap junction alpha-5 protein (Connexin 40) (Cx40)                                             | 580  | e-165    |
|             |  |               |                  | AAA91833.1  | connexin 40                                                                                              | 580  | e-165    |
|             |  |               |                  | AAD37801.1  | AF151979_1 connexin 40                                                                                   | 580  | e-165    |
|             |  |               |                  | AAA60457.2  | connexin40                                                                                               | 580  | e-165    |
|             |  |               |                  | AAH13313.1  | gap junction protein, alpha 5, 40kD (connexin 40)                                                        | 580  | e-165    |
|             |  |               |                  | I38429      | connexin40                                                                                               | 575  | e-164    |
|             |  |               |                  | NP_068773.2 | gap junction protein, alpha 3, 46kDa (connexin 46); gap junction protein, alpha 3, 46kD (connexin 46)    | 301  | 1.00e-81 |
|             |  |               |                  | CAC16957.1  | bA264J4.3 (novel connexin (gap junction protein)                                                         | 301  | 1.00e-81 |
|             |  |               |                  | Q9Y6H8      | CXA3_HUMAN Gap junction alpha-3 protein (Connexin 46) (Cx46)                                             | 301  | 1.00e-81 |

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|-------------|--|---------|------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |  |         |                  | AAD42925.1  | gap-junction protein alpha 3                                                                                                                                                                                                   | 301 | 1.00e-81 |
|             |  |         |                  |             | gap junction protein, alpha 8, 50kDa (connexin 50); gap junction membrane channel protein alpha-8; connexin 50; Gap junction membrane channel protein alpha-8 (connexin 50); gap junction protein, alpha 8, 50kD (connexin 50) | 299 | 4.00e-81 |
|             |  |         |                  | NP_005258.1 |                                                                                                                                                                                                                                | 299 | 4.00e-81 |
|             |  |         |                  | I39176      | intrinsic membrane protein MP70                                                                                                                                                                                                | 299 | 4.00e-81 |
|             |  |         |                  | AAA77062.1  | gap junction membrane channel protein alpha-8                                                                                                                                                                                  | 299 | 4.00e-81 |
|             |  |         |                  | P48165      | CXA8_HUMAN Gap junction alpha-8 protein (Connexin 50) (Cx50) (Lens fiber protein MP70)                                                                                                                                         | 296 | 3.00e-80 |
|             |  |         |                  | AAF32309.1  | AF217524_1 gap junction protein alpha 8                                                                                                                                                                                        | 296 | 3.00e-80 |
|             |  |         |                  | AAK55516.1  | AF271261_1 connexin 58                                                                                                                                                                                                         | 282 | 5.00e-76 |
|             |  |         |                  | NP_110399.1 | connexin 59; gap junction alpha 10                                                                                                                                                                                             | 282 | 5.00e-76 |
|             |  |         |                  | P57773      | CXAA_HUMAN Gap junction alpha-10 protein (Connexin 59) (Cx59)                                                                                                                                                                  | 282 | 5.00e-76 |
|             |  |         |                  | AAG09406.1  | AF179597_1 connexin 59                                                                                                                                                                                                         | 282 | 5.00e-76 |
|             |  |         |                  | AAD56533.1  | AF180815_1 truncated connexin 37 polymorph                                                                                                                                                                                     | 270 | 2.00e-72 |
|             |  |         |                  | NP_115991.1 | connexin 62                                                                                                                                                                                                                    | 267 | 2.00e-71 |
|             |  |         |                  | AAK51676.1  | AF296766_1 connexin 62                                                                                                                                                                                                         | 267 | 2.00e-71 |
|             |  |         |                  | CAC93847.1  | connexin62                                                                                                                                                                                                                     | 267 | 2.00e-71 |
| NM_008314   |  |         | U:(C-IR)<br>4.49 |             |                                                                                                                                                                                                                                |     |          |
| NP_032340.1 |  |         | U:(C-D)<br>2.43  |             |                                                                                                                                                                                                                                |     |          |
|             |  | Mm.4835 |                  | I37107      | 5-HT5A serotonin receptor                                                                                                                                                                                                      | 584 | e-166    |
|             |  |         |                  | CAA57168.1  | 5-HT5A serotonin receptor                                                                                                                                                                                                      | 584 | e-166    |
|             |  |         |                  | AAM21132.1  | AF498985_1 5-hydroxytryptamine receptor 5A                                                                                                                                                                                     | 584 | e-166    |
|             |  |         |                  | BAA94458.1  | 5-hydroxytryptamine (serotonin) receptor 1E                                                                                                                                                                                    | 212 | 2.00e-54 |
|             |  |         |                  | NP_000856.1 | 5-hydroxytryptamine (serotonin) receptor 1E                                                                                                                                                                                    | 212 | 2.00e-54 |
|             |  |         |                  | P28566      | 5H1E HUMAN 5-hydroxytryptamine 1E receptor (5-HT-1E) (Serotonin receptor) (5-HT1E) (S31)                                                                                                                                       | 212 | 2.00e-54 |
|             |  |         |                  | A45260      | serotonin receptor 1E                                                                                                                                                                                                          | 212 | 2.00e-54 |

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|--|--|--|--|-------------|----------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|  |  |  |  | CAA77558.1  | serotonin receptor                                                                                                         |  | 212 | 2.00e-54 |
|  |  |  |  | AAA58353.1  | serotonin receptor                                                                                                         |  | 212 | 2.00e-54 |
|  |  |  |  | AAA58355.1  | serotonin receptor                                                                                                         |  | 212 | 2.00e-54 |
|  |  |  |  | CAC10582.1  | bA76H14.2 (5-hydroxytryptamine (serotonin) receptor 1E)                                                                    |  | 212 | 2.00e-54 |
|  |  |  |  | AAM21127.1  | AF498980_1 5-hydroxytryptamine receptor 1E                                                                                 |  | 212 | 2.00e-54 |
|  |  |  |  | NP_000857.1 | 5-hydroxytryptamine (serotonin) receptor 1F; 5-hydroxytryptamine receptor 1F                                               |  | 209 | 1.00e-53 |
|  |  |  |  | P30939      | 5H1F_HUMAN 5-hydroxytryptamine 1F receptor (5-HT-1F) (Serotonin receptor)                                                  |  | 209 | 1.00e-53 |
|  |  |  |  | A47321      | serotonin receptor 1F                                                                                                      |  | 209 | 1.00e-53 |
|  |  |  |  | AAA36605.1  | serotonin receptor                                                                                                         |  | 209 | 1.00e-53 |
|  |  |  |  | AAA36646.1  | serotonin receptor                                                                                                         |  | 209 | 1.00e-53 |
|  |  |  |  | AAM21128.1  | AF498981_1 5-hydroxytryptamine receptor 1F                                                                                 |  | 209 | 1.00e-53 |
|  |  |  |  | BAA90453.1  | 5-hydroxytryptamine (serotonin) receptor 1F                                                                                |  | 209 | 1.00e-53 |
|  |  |  |  | XP_003692.2 | similar to 5-hydroxytryptamine 1A receptor (5-HT-1A) (Serotonin receptor) (5-HT1A) (G-21)                                  |  | 205 | 1.00e-52 |
|  |  |  |  | P08908      | 5H1A_HUMAN 5-hydroxytryptamine 1A receptor (5-HT-1A) (Serotonin receptor)                                                  |  | 205 | 1.00e-52 |
|  |  |  |  | I38209      | serotonin receptor 1A                                                                                                      |  | 205 | 1.00e-52 |
|  |  |  |  | CAA40962.1  | serotonin 5-HT1a receptor                                                                                                  |  | 205 | 1.00e-52 |
|  |  |  |  | AAA66493.1  | serotonin receptor                                                                                                         |  | 205 | 1.00e-52 |
|  |  |  |  | BAA94488.1  | serotonin receptor 1A                                                                                                      |  | 205 | 1.00e-52 |
|  |  |  |  | AAM21125.1  | AF498978_1 5-hydroxytryptamine receptor 1A                                                                                 |  | 205 | 1.00e-52 |
|  |  |  |  | XP_092299.1 | similar to KIAA0622 protein - human (fragment)                                                                             |  | 205 | 1.00e-52 |
|  |  |  |  | NP_000854.1 | 5-hydroxytryptamine (serotonin) receptor 1B; 5-HT1B; 5-HT1DB                                                               |  | 204 | 2.00e-52 |
|  |  |  |  | P28222      | 5H1B_HUMAN 5-hydroxytryptamine 1B receptor (5-HT-1B) (Serotonin receptor)(5-HT-1D-beta) (Serotonin 1D beta receptor) (S12) |  | 204 | 2.00e-52 |
|  |  |  |  | JN0268      | serotonin receptor 1B                                                                                                      |  | 204 | 2.00e-52 |
|  |  |  |  | AAA58675.1  | serotonin 1Db receptor                                                                                                     |  | 204 | 2.00e-52 |

|             |          |                  |  |             |                                                                                                                                                |     |          |
|-------------|----------|------------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |                  |  | AAA36029.1  | serotonin receptor                                                                                                                             | 204 | 2.00e-52 |
|             |          |                  |  | AAA36030.1  | 5-hydroxytryptamine 1D receptor                                                                                                                | 204 | 2.00e-52 |
|             |          |                  |  | BAA01763.1  | serotonin 1B receptor                                                                                                                          | 204 | 2.00e-52 |
|             |          |                  |  | AAA60316.1  | serotonin 1D receptor                                                                                                                          | 204 | 2.00e-52 |
|             |          |                  |  | CAB51537.1  | dJ501M23.1 (5-hydroxytryptamine (serotonin) receptor 1B)                                                                                       | 204 | 2.00e-52 |
|             |          |                  |  | BAA94455.1  | 5-hydroxytryptamine (serotonin) receptor 1B                                                                                                    | 204 | 2.00e-52 |
|             |          |                  |  | 2209242B    | serotonin receptor:ISOTYPE=1D-beta                                                                                                             | 204 | 2.00e-52 |
|             |          |                  |  | NP_000515.1 | 5-hydroxytryptamine (serotonin) receptor 1A                                                                                                    | 202 | 2.00e-51 |
|             |          |                  |  | CAA31908.1  | receptor protein (AA 1 - 421)                                                                                                                  | 202 | 2.00e-51 |
|             |          |                  |  | AAA36440.1  | guanine nucleotide-binding regulatory protein-coupled recepto                                                                                  | 202 | 2.00e-51 |
|             |          |                  |  | 1311340A    | G protein coupled receptor                                                                                                                     | 202 | 2.00e-51 |
| NM_009183   |          | U:(C-IR)<br>4.19 |  |             |                                                                                                                                                |     |          |
| NP_033209.1 | Mm.10701 | U:(C-D)<br>2.35  |  | NP_005659.1 | sialyltransferase 8D (alpha-2, 8-polysialyltransferase); Polysialyltransferase;<br>sialyltransferase 8 (alpha-2, 8-polysialyltransferase) D    | 714 | 0        |
|             |          |                  |  | Q92187      | SI8D_HUMAN CMP-N-acetylneuraminase-poly-alpha-2,8-sialyl transferase<br>(Alpha-2,8-sialyltransferase 8D) (ST8Sia IV) (Polysialyltransferase-1) | 714 | 0        |
|             |          |                  |  | I59403      | alpha-2,8-polysialyltransferase                                                                                                                | 714 | 0        |
|             |          |                  |  | AAC41775.1  | alpha-2,8-polysialyltransferase                                                                                                                | 714 | 0        |
|             |          |                  |  | 2116443A    | polysialyltransferase                                                                                                                          | 714 | 0        |
|             |          |                  |  | NP_006002.1 | sialyltransferase 8B (alpha-2, 8-sialyltransferase); Sialyltransferase X; sialyltransferase<br>8 (alpha-2, 8-sialyltransferase) B              | 429 | e-119    |
|             |          |                  |  | Q92186      | SI8B_HUMAN Alpha-2,8-sialyltransferase 8B (ST8Sia II) (Sialyltransferase X)(STX)                                                               | 429 | e-119    |
|             |          |                  |  | I39169      | sialyltransferase                                                                                                                              | 429 | e-119    |
|             |          |                  |  | AAC24458.1  | sialyltransferase                                                                                                                              | 429 | e-119    |
|             |          |                  |  | AAB51242.1  | sialyltransferase X                                                                                                                            | 429 | e-119    |
|             |          |                  |  | 2123358A    | sialyltransferase STX                                                                                                                          | 429 | e-119    |
|             |          |                  |  | B54898      | STX protein                                                                                                                                    | 330 | 2.00e-89 |

|             |          |                  |  |             |                                                                                                                                                           |     |          |          |
|-------------|----------|------------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|----------|
|             |          |                  |  | AAA36613.1  | sialyltransferase                                                                                                                                         |     | 330      | 2.00e-89 |
|             |          |                  |  | AAH27866.1  | Similar to sialyltransferase 8D (alpha-2, 8-polysialyltransferase)                                                                                        |     | 320      | 1.00e-86 |
|             |          |                  |  | AAC15901.1  | alpha-2, 8-sialyltransferase III                                                                                                                          |     | 219      | 3.00e-56 |
|             |          |                  |  | NP_056963.1 | sialyltransferase 8C (alpha2,3Galbeta1,4GlcNAcalpha 2,8-sialyltransferase); alpha-2, 8-sialyltransferase III                                              |     | 215      | 8.00e-55 |
|             |          |                  |  | O43173      | SI8C_HUMAN Sia-alpha-2,3-Gal-beta-1,4-GlcNAc-R:alpha 2,8-sialyltransferase (Alpha-2,8-sialyltransferase 8C) (ST8Sia III)                                  |     | 215      | 8.00e-55 |
|             |          |                  |  | AAB87642.1  | Sia alpha2,3Galbeta1,4GlcNAcalpha 2,8-sialyltransferase                                                                                                   |     | 215      | 8.00e-55 |
| NM_009520   |          | U:(C-IR)<br>4.15 |  |             | wingless-type MMTV integration site family, member 2B, isoform WNT-2B2;                                                                                   |     |          |          |
| NP_033546.1 | Mm.10740 | U:(C-D)<br>3.21  |  | NP_078613.1 | wingless-type MMTV integration site family, member 13; XWNT2, Xenopus, homolog of                                                                         | 726 | 0        |          |
|             |          |                  |  | Q93097      | WN2B_HUMAN WNT-2B protein precursor (WNT-13)                                                                                                              | 726 | 0        |          |
|             |          |                  |  | BAB11985.1  | WNT-2B Isoform 2                                                                                                                                          | 726 | 0        |          |
|             |          |                  |  | NP_004176.2 | wingless-type MMTV integration site family, member 2B, isoform WNT-2B1; wingless-type MMTV integration site family, member 13; XWNT2, Xenopus, homolog of | 702 | 0        |          |
|             |          |                  |  | BAB11984.1  | WNT-2B Isoform 1                                                                                                                                          | 702 | 0        |          |
|             |          |                  |  | T09612      | secreted glycoprotein Wnt-13                                                                                                                              | 696 | 0        |          |
|             |          |                  |  | CAA96283.1  | Wnt-13                                                                                                                                                    | 696 | 0        |          |
|             |          |                  |  | NP_003382.1 | wingless-type MMTV integration site family member 2 precursor; int-1 related protein; oncogene INT1-like 1; secreted growth factor                        | 535 | e-152    |          |
|             |          |                  |  | P09544      | WNT2_HUMAN WNT-2 protein precursor (IRP protein) (Int-1 related protein)                                                                                  | 535 | e-152    |          |
|             |          |                  |  | S00834      | int-1-like protein 1 precursor                                                                                                                            | 535 | e-152    |          |
|             |          |                  |  | CAA30725.1  | Irp protein (AA 1-360)                                                                                                                                    | 535 | e-152    |          |
|             |          |                  |  | AAH29854.1  | wingless-type MMTV integration site family member 2                                                                                                       | 535 | e-152    |          |
|             |          |                  |  | AAB67043.1  | secreted growth factor                                                                                                                                    | 404 | e-112    |          |
|             |          |                  |  | NP_003383.1 | wingless-type MMTV integration site family, member 5A precursor; proto-oncogene Wnt-5A precursor; WNT-5A protein precursor                                | 360 | 2.00e-99 |          |

|            |                  |          |                          |                                                                                                        |     |          |
|------------|------------------|----------|--------------------------|--------------------------------------------------------------------------------------------------------|-----|----------|
|            |                  |          | P41221                   | WN5A_HUMAN WNT-5A protein precursor                                                                    | 360 | 2.00e-99 |
|            |                  |          | A48914                   | proto-oncogene Wnt-5A precursor                                                                        | 360 | 2.00e-99 |
|            |                  |          | AAA16842.1               | hWNT5A                                                                                                 | 360 | 2.00e-99 |
|            |                  |          | NP_116031.1              | wingless-type MMTV integration site family, member 5B precursor; WNT-5B protein precursor              | 358 | 1.00e-98 |
|            |                  |          | NP_110402.2              | wingless-type MMTV integration site family, member 5B precursor;                                       | 358 | 1.00e-98 |
|            |                  |          | WNT-5B protein precursor |                                                                                                        | 358 | 1.00e-98 |
|            |                  |          | Q9H1J7                   | WN5B_HUMAN WNT-5B protein precursor                                                                    | 358 | 1.00e-98 |
|            |                  |          | AAH01749.1               | AAH01749 Similar to wingless-related MMTV integration site 5B                                          | 358 | 1.00e-98 |
|            |                  |          | BAB62039.1               | WNT5B                                                                                                  | 358 | 1.00e-98 |
|            |                  |          | NP_478679.1              | wingless-type MMTV integration site family, member 7B precursor                                        | 355 | 1.00e-97 |
|            |                  |          | P56706                   | WN7B_HUMAN WNT-7B protein precursor                                                                    | 355 | 1.00e-97 |
|            |                  |          | BAB68399.1               | WNT7B                                                                                                  | 355 | 1.00e-97 |
|            |                  |          | AAH34923.1               | wingless-type MMTV integration site family, member 7B                                                  | 355 | 1.00e-97 |
|            |                  |          | AAN32640.1               | AF416743_1 WNT7B                                                                                       | 355 | 1.00e-97 |
|            |                  |          | NP_004616.2              | wingless-type MMTV integration site family, member 7A precursor; proto-oncogene Wnt7a protein          | 348 | 1.00e-95 |
|            |                  |          | AAH08811.1               | Unknown (protein for MGC:10346)                                                                        | 348 | 1.00e-95 |
|            |                  |          | AAG38659.1               | WNT5b precursor                                                                                        | 348 | 2.00e-95 |
| AK011231   | U:(C-IR)<br>3.61 |          |                          |                                                                                                        |     |          |
| BAB27481.1 | U:(C-D)<br>2.66  |          |                          |                                                                                                        |     |          |
|            | U:(IR-D)<br>2.42 | Mm.22533 | NP_055330.1              | CCR4-NOT transcription complex, subunit 2; NOT2 (negative regulator of transcription 2, yeast) homolog | 877 | 0        |
|            |                  |          | AAF29827.1               | AF180473_1 Not2p                                                                                       | 877 | 0        |
|            |                  |          | AAH02597.1               | CCR4-NOT transcription complex, subunit 2                                                              | 877 | 0        |

|             |          |                 |  |             |                                                                                                                                                          |      |          |
|-------------|----------|-----------------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |          |                 |  | AAH11826.1  | Similar to CCR4-NOT transcription complex, subunit 2                                                                                                     | 877  | 0        |
|             |          |                 |  | BAA91313.1  | unnamed protein product                                                                                                                                  | 751  | 0        |
|             |          |                 |  | AAF29095.1  | AF161480_1 HSPC131                                                                                                                                       | 729  | 0        |
|             |          |                 |  | AAG39297.1  | AF113226_1 MSTP046                                                                                                                                       | 728  | 0        |
|             |          |                 |  | T46494      | hypothetical protein DKFZp434M0572.1                                                                                                                     | 326  | 8.00e-89 |
|             |          |                 |  | CAB70869.1  | hypothetical protein                                                                                                                                     | 326  | 8.00e-89 |
| NM_009613   |          | U:(C-IR)<br>3.6 |  |             |                                                                                                                                                          |      |          |
| NP_033743.1 | Mm.89854 | U:(C-D)<br>2.86 |  | NP_002381.2 | a disintegrin and metalloprotease domain 11, isoform 1 preproprotein;<br>metalloproteinase-like, disintegrin-like, cysteine-rich protein                 | 1454 | 0        |
|             |          |                 |  | BAA32352.1  | MDC/ADAM11                                                                                                                                               | 1454 | 0        |
|             |          |                 |  | O75078      | AD11_HUMAN ADAM 11 precursor (A disintegrin and metalloproteinase domain 11) (Metalloproteinase-like, disintegrin-like, and cysteine-rich protein) (MDC) | 1451 | 0        |
|             |          |                 |  | I65967      | disintegrin-like metalloproteinase (EC 3.4.24.-), splice form 2                                                                                          | 1345 | 0        |
|             |          |                 |  | BAA06670.1  | metalloprotease/disintegrin-like protein                                                                                                                 | 1340 | 0        |
|             |          |                 |  | NP_067625.1 | a disintegrin and metalloprotease domain 11, isoform 2 preproprotein;<br>metalloproteinase-like, disintegrin-like, cysteine-rich protein                 | 1011 | 0        |
|             |          |                 |  | S38539      | disintegrin-like metalloproteinase (EC 3.4.24.-), splice form 1                                                                                          | 1011 | 0        |
|             |          |                 |  | AAB29191.1  | MDC=metalloprotease/disintegrin-like cysteine-rich protein [human, cerebellum, Peptide, 524 aa]                                                          | 1011 | 0        |
|             |          |                 |  | BAA04213.1  | MDC protein                                                                                                                                              | 1011 | 0        |
|             |          |                 |  | BAA06671.1  | metalloprotease/disintegrin-like protein                                                                                                                 | 1008 | 0        |
|             |          |                 |  | NP_068367.1 | a disintegrin and metalloproteinase domain 22 isoform 5 proprotein; MDC2 delta                                                                           | 825  | 0        |
|             |          |                 |  | BAA32350.1  | MDC2 beta                                                                                                                                                | 825  | 0        |
|             |          |                 |  | AAF22476.2  | AF073291_1 MDC2                                                                                                                                          | 825  | 0        |
|             |          |                 |  | NP_057435.2 | a disintegrin and metalloproteinase domain 22 isoform 3 proprotein; MDC2 delta                                                                           | 825  | 0        |
|             |          |                 |  | NP_068368.2 | a disintegrin and metalloproteinase domain 22 isoform 2 proprotein; MDC2 delta                                                                           | 825  | 0        |

|             |               |                  |             |  |                                                                                                                              |      |          |  |
|-------------|---------------|------------------|-------------|--|------------------------------------------------------------------------------------------------------------------------------|------|----------|--|
| AK002979    |               | U:(C-IR)<br>3.58 | NP_056537.1 |  | calcyon                                                                                                                      |      |          |  |
| BAB22492.1  | Mm.19588<br>1 | U:(C-D)<br>2.07  | Q9NYX4      |  | D1IP_HUMAN D1 dopamine receptor-interacting protein calcyon                                                                  | 336  | 5.00e-92 |  |
|             |               |                  | AAF34714.1  |  | AF225903_1 D1 dopamine receptor interacting protein calcyon                                                                  | 336  | 5.00e-92 |  |
|             |               |                  | AAH38978.1  |  | Similar to calcyon; D1 dopamine receptor-interacting protein                                                                 | 336  | 5.00e-92 |  |
| NM_008714   |               | U:(C-IR)<br>3.55 |             |  |                                                                                                                              |      |          |  |
| NP_032740.1 | Mm.31255      | U:(C-D)<br>2.19  | P46531      |  | NTC1_HUMAN Neurogenic locus notch homolog protein 1 precursor (Notch 1) (hN1) (Translocation-associated notch protein TAN-1) | 4646 | 0        |  |
|             |               |                  | AAG33848.1  |  | AF308602_1 NOTCH 1                                                                                                           | 4646 | 0        |  |
|             |               |                  | A40043      |  | notch protein homolog TAN-1 precursor                                                                                        | 4528 | 0        |  |
|             |               |                  | AAA60614.1  |  | TAN1                                                                                                                         | 4482 | 0        |  |
|             |               |                  | NP_077719.2 |  | notch 2 preproprotein                                                                                                        | 2628 | 0        |  |
|             |               |                  | AAG37073.1  |  | AF315356_1 NOTCH2 protein                                                                                                    | 2627 | 0        |  |
|             |               |                  | Q04721      |  | NTC2_HUMAN Neurogenic locus notch homolog protein 2 precursor (Notch 2) (hN2)                                                | 2627 | 0        |  |
|             |               |                  | AAA36377.2  |  | NOTCH 2                                                                                                                      | 2627 | 0        |  |
|             |               |                  | AAC14346.1  |  | Notch3                                                                                                                       | 2065 | 0        |  |
|             |               |                  | NP_000426.1 |  | Notch homolog 3                                                                                                              | 2065 | 0        |  |
|             |               |                  | Q9UM47      |  | NTC3_HUMAN Neurogenic locus notch homolog protein 3 precursor (Notch 3)                                                      | 2065 | 0        |  |
|             |               |                  | S78549      |  | notch3 protein                                                                                                               | 2065 | 0        |  |
|             |               |                  | AAB91371.1  |  | Notch3                                                                                                                       | 2065 | 0        |  |
|             |               |                  | AAC15789.1  |  | Notch 3                                                                                                                      | 2065 | 0        |  |
|             |               |                  |             |  | Notch homolog 4 (Drosophila); Notch, drosophila, homolog of, 4; Notch (Drosophila) homolog 4                                 | 1023 | 0        |  |
|             |               |                  | NP_004548.1 |  |                                                                                                                              | 1023 | 0        |  |
|             |               |                  | Q99466      |  | NTC4_HUMAN Neurogenic locus notch homolog protein 4 precursor (Notch 4) (hNotch4)                                            | 1023 | 0        |  |



|             |          |                  |             |                                                                                            |  |      |          |
|-------------|----------|------------------|-------------|--------------------------------------------------------------------------------------------|--|------|----------|
|             |          |                  | AAC32288.1  | Notch4                                                                                     |  | 1023 | 0        |
| AK012553    |          | U:(C-IR)<br>3.54 |             |                                                                                            |  |      |          |
| BAB28313.1  | Mm.45628 | U:(C-D)<br>2.46  | NP_001575.1 | chromosome 11 open reading frame 8; 239FB                                                  |  | 627  | e-180    |
|             |          |                  | Q15777      | 239F_HUMAN Fetal brain protein 239                                                         |  | 627  | e-180    |
|             |          |                  | AAC50564.1  | 239FB gene product                                                                         |  | 627  | e-180    |
|             |          |                  | AAH31582.1  | chromosome 11 open reading frame 8                                                         |  | 627  | e-180    |
|             |          |                  | 2122285A    | 239FB gene                                                                                 |  | 627  | e-180    |
|             |          |                  | NP_001576.2 | chromosome 22 open reading frame 1; 239AB                                                  |  | 518  | e-147    |
|             |          |                  | O15442      | 239A_HUMAN Adult brain protein 239                                                         |  | 518  | e-147    |
|             |          |                  | AAC51673.2  | 239AB                                                                                      |  | 518  | e-147    |
|             |          |                  | AAH28035.1  | Unknown (protein for MGC:40027)                                                            |  | 518  | e-147    |
|             |          |                  | CAC48257.1  | dJ873F21.1 (brain protein 239)                                                             |  | 284  | 2.00e-76 |
|             |          |                  | CAC10467.1  | dJ710M3.1 (chromosome 11 open reading frame 8(Fetal brain protein 239))                    |  | 253  | 5.00e-67 |
| NM_007412   |          | U:(C-IR)<br>3.52 |             |                                                                                            |  |      |          |
| NP_031438.1 | Mm.2857  | U:(C-D)<br>3.08  | NP_009195.1 | adrenomedullin receptor; G-protein-coupled receptor similar to the adrenomedullin receptor |  | 563  | e-160    |
|             |          |                  | O15218      | ADMR_HUMAN Adrenomedullin receptor (AM-R)                                                  |  | 563  | e-160    |
|             |          |                  | JC5784      | adrenomedullin receptor                                                                    |  | 563  | e-160    |
|             |          |                  | CAA73910.1  | G-protein coupled receptor                                                                 |  | 563  | e-160    |
|             |          |                  | AAH34761.1  | adrenomedullin receptor                                                                    |  | 563  | e-160    |
|             |          |                  | P25106      | RDC1_HUMAN G protein-coupled receptor RDC1 homolog                                         |  | 197  | 5.00e-50 |
|             |          |                  | A39714      | G protein-coupled receptor RDC1                                                            |  | 197  | 5.00e-50 |
|             |          |                  | AAA62370.1  | orphan receptor                                                                            |  | 197  | 5.00e-50 |
|             |          |                  | XP_051522.2 | similar to G protein-coupled receptor RDC1 homolog                                         |  | 197  | 5.00e-50 |
|             |          |                  | AAH36661.1  | Unknown (protein for MGC:33224)                                                            |  | 196  | 6.00e-50 |

|             |               |                  |                                                                                                                                                           |              |
|-------------|---------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| NM_007488   |               | U:(C-IR)<br>3.41 |                                                                                                                                                           |              |
| NP_031514.1 | Mm.4813       |                  | Q9HBZ2 ARN2_HUMAN Aryl hydrocarbon receptor nuclear translocator 2 (ARNT protein 2)                                                                       | 1192 0       |
|             |               |                  | AAG15310.1 AF185610_1 aryl-hydrocarbon receptor nuclear translocator 2                                                                                    | 1192 0       |
|             |               |                  | NP_055677.1 aryl-hydrocarbon receptor nuclear translocator 2; KIAA0307 gene product; aryl hydrocarbon receptor nuclear translocator 2                     | 1191 0       |
|             |               |                  | BAA20766.1 KIAA0307                                                                                                                                       | 1191 0       |
|             |               |                  | AAH36099.1 Unknown (protein for MGC:33872)                                                                                                                | 1165 0       |
|             |               |                  | NP_001659.1 aryl hydrocarbon receptor nuclear translocator                                                                                                | 728 0        |
|             |               |                  | ARNT_HUMAN Aryl hydrocarbon receptor nuclear translocator (ARNT protein)                                                                                  |              |
|             |               |                  | P27540 (Dioxin receptor, nuclear translocator) (Hypoxia-inducible factor 1 beta) (HIF-1 beta)                                                             | 728 0        |
|             |               |                  | I59550 aryl hydrocarbon receptor nuclear translocator Arnt [imported]                                                                                     | 728 0        |
|             |               |                  | AAA51777.1 Arnt                                                                                                                                           | 728 0        |
|             |               |                  | CAC21446.1 aryl hydrocarbon receptor nuclear translocator, ARNT                                                                                           | 728 0        |
|             |               |                  | CAD38953.1 hypothetical protein                                                                                                                           | 714 0        |
|             |               |                  | AAC03365.1 aryl hydrocarbon receptor nuclear translocator; Arnt                                                                                           | 412 e-115    |
|             |               |                  | O00327 BMAL_HUMAN BMAL1 protein (Brain and muscle ARNT-like 1) (Member of PAS protein 3) (Basic-helix-loop-helix-PAS orphan MOP3) (BHLH-PAS protein JAP3) | 301 2.00e-81 |
|             |               |                  | BAA19968.1 BMAL1a                                                                                                                                         | 301 2.00e-81 |
|             |               |                  | NP_001169.2 aryl hydrocarbon receptor nuclear translocator-like                                                                                           | 301 2.00e-81 |
|             |               |                  | AAB37248.1 bHLH-PAS protein JAP3                                                                                                                          | 301 2.00e-81 |
|             |               |                  | AAC24353.1 basic-helix-loop-helix-PAS orphan MOP3                                                                                                         | 301 2.00e-81 |
|             |               |                  | AAC51213.1 PAS protein 3                                                                                                                                  | 301 3.00e-81 |
|             |               |                  | IC5405 brain and muscle Ah receptor nuclear translocator-like protein, BMAL1b                                                                             | 300 5.00e-81 |
|             |               |                  | BAA19935.1 BMAL1b                                                                                                                                         | 300 5.00e-81 |
| NM_009004   |               | U:(C-IR)<br>3.26 |                                                                                                                                                           |              |
| NP_033030.1 | Mm.19663<br>8 | U:(C-D)<br>2.41  | NP_005724.1 RAB6 interacting, kinesin-like (rabkinesin6)                                                                                                  | 1345 0       |

|             |         |                  |             |                                                                          |      |          |
|-------------|---------|------------------|-------------|--------------------------------------------------------------------------|------|----------|
|             |         |                  | O95235      | RB6K_HUMAN Rabkinesin-6 (RAB6-interacting kinesin-like protein) (GG10_2) | 1345 | 0        |
|             |         |                  | AAC83230.1  | rabkinesin6                                                              | 1345 | 0        |
|             |         |                  | AAD37806.1  | AF153329_1 RAB6KIFL                                                      | 1345 | 0        |
|             |         |                  | AAH12999.1  | AAH12999 Similar to RAB6 interacting, kinesin-like (rabkinesin 6)        | 1345 | 0        |
|             |         |                  | NP_057279.1 | M-phase phosphoprotein 1; mitotic kinesin-like protein                   | 333  | 9.00e-91 |
|             |         |                  | T17272      | hypothetical protein DKFZp434B0435.1                                     | 333  | 9.00e-91 |
|             |         |                  | CAB55962.1  | hypothetical protein                                                     | 333  | 9.00e-91 |
|             |         |                  | BAB69456.1  | mitotic kinesin-related protein                                          | 326  | 1.00e-88 |
|             |         |                  | NP_004847.2 | kinesin-like 5 isoform 2; mitotic kinesin-like 1                         | 201  | 4.00e-51 |
|             |         |                  | Q02241      | KNS5_HUMAN Mitotic kinesin-like protein-1 (Kinesin-like protein 5)       | 201  | 4.00e-51 |
|             |         |                  | CAA47628.2  | mitotic kinase-like protein-1                                            | 201  | 4.00e-51 |
|             |         |                  | NP_612565.1 | kinesin-like 5 isoform 1; mitotic kinesin-like 1                         | 201  | 4.00e-51 |
|             |         |                  | AAH17705.1  | AAH17705 kinesin-like 5 (mitotic kinesin-like protein 1)                 | 201  | 4.00e-51 |
| NM_007730   |         | U:(C-IR)<br>3.18 |             |                                                                          |      |          |
| NP_031756.1 | Mm.3819 | U:(C-D)<br>2.18  | NP_004361.2 | alpha 1 type XII collagen, long isoform precursor                        | 5003 | 0        |
|             |         |                  | Q99715      | CA1C_HUMAN Collagen alpha 1(XII) chain precursor                         | 4987 | 0        |
|             |         |                  | AAC51244.1  | collagen type XII alpha-1                                                | 4987 | 0        |
|             |         |                  | NP_542376.1 | alpha 1 type XII collagen, short isoform precursor                       | 2961 | 0        |
|             |         |                  | CAB71222.1  | dJ238D15.1 (collagen, type XII, alpha 1)                                 | 2769 | 0        |
|             |         |                  | CAB65984.1  | dJ234P15.1 (collagen, type XII, alpha 1)                                 | 1046 | 0        |
|             |         |                  | AAC01506.1  | type XII collagen                                                        | 893  | 0        |
|             |         |                  | A40970      | undulin 1                                                                | 518  | e-146    |
|             |         |                  | AAA36794.1  | undulin 1                                                                | 518  | e-146    |
|             |         |                  | CAA72402.1  | collagen type XIV                                                        | 497  | e-139    |
|             |         |                  | CAC19497.1  | bA209D8.1 (collagen type XII, alpha 1)                                   | 464  | e-129    |

|                          |              |                  |             |                                                                                                                                                                                                                                                                                                                 |      |          |
|--------------------------|--------------|------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|                          |              |                  | AAH14640.1  | Unknown (protein for MGC:15451)                                                                                                                                                                                                                                                                                 | 461  | e-129    |
|                          |              | U:(C-IR)<br>3.17 | A35175      | mucin 1 precursor, repetitive splice form A [validated]                                                                                                                                                                                                                                                         | 370  | e-102    |
| NM_013605<br>NP_038633.1 | Mm.1619<br>3 | U:(C-D)<br>3.4   |             |                                                                                                                                                                                                                                                                                                                 |      |          |
|                          |              |                  | NP_002447.2 | mucin 1, transmembrane; peanut-reactive urinary mucin; episialin; polymorphic epithelial mucin; epithelial membrane antigen; DF3 antigen; H23 antigen                                                                                                                                                           | 368  | e-101    |
|                          |              |                  | P15941      | MUC1_HUMAN Mucin 1 precursor (MUC-1) (Polymorphic epithelial mucin) (PEM) (PEMT) (Episialin) (Tumor-associated mucin) (Carcinoma-associated mucin) (Tumor-associated epithelial membrane antigen) (EMA) (H23AG) (Peanut-reactive urinary mucin) (PUM) (Breast carcinoma-associated antigen DF3) (CD227 antigen) | 368  | e-101    |
|                          |              |                  | AAA60019.1  | mucin                                                                                                                                                                                                                                                                                                           | 368  | e-101    |
|                          |              |                  | CAA36478.1  | precursor polypeptide (AA -21 to 494)                                                                                                                                                                                                                                                                           | 325  | 2.00e-88 |
|                          |              |                  | AAA59876.1  | polymorphic epithelial mucin                                                                                                                                                                                                                                                                                    | 317  | 4.00e-86 |
|                          |              |                  | AAB53150.1  | polymorphic epithelial mucin                                                                                                                                                                                                                                                                                    | 317  | 4.00e-86 |
|                          |              |                  | XP_053256.8 | similar to polymorphic epithelial mucin                                                                                                                                                                                                                                                                         | 317  | 4.00e-86 |
|                          |              |                  | AAA35805.1  | episialin variant A precursor                                                                                                                                                                                                                                                                                   | 298  | 2.00e-80 |
|                          |              |                  | AAA35807.1  | episialin variant B precursor                                                                                                                                                                                                                                                                                   | 298  | 2.00e-80 |
|                          |              |                  | AAD10858.1  | MUC-1/Z mucin short variant                                                                                                                                                                                                                                                                                     | 274  | 5.00e-73 |
|                          |              |                  | S48146      | mucin 1 precursor, non-repetitive splice form Y [validated]                                                                                                                                                                                                                                                     | 272  | 1.00e-72 |
|                          |              |                  | CAA56734.1  | MUC1                                                                                                                                                                                                                                                                                                            | 272  | 1.00e-72 |
|                          |              |                  | AAD10857.1  | MUC-1/Y mucin short variant                                                                                                                                                                                                                                                                                     | 272  | 1.00e-72 |
|                          |              |                  | AAD27842.1  | AF125525_1 MUC1/Y mucin precursor                                                                                                                                                                                                                                                                               | 271  | 3.00e-72 |
|                          |              |                  | AAD10856.1  | MUC-1/X mucin short variant                                                                                                                                                                                                                                                                                     | 214  | 4.00e-56 |
| NM_008652<br>NP_032678.1 |              | U:(C-IR)<br>3.11 |             |                                                                                                                                                                                                                                                                                                                 |      |          |
|                          |              | U:(C-D)<br>2     |             |                                                                                                                                                                                                                                                                                                                 |      |          |
|                          | Mm.4594      |                  | NP_002457.1 | v-myb myeloblastosis viral oncogene homolog (avian)-like 2; B-MYB; v-myb avian myeloblastosis viral oncogene homolog-like 2                                                                                                                                                                                     | 1123 | 0        |
|                          |              |                  | P10244      | MYBB_HUMAN Myb-related protein B (B-Myb)                                                                                                                                                                                                                                                                        | 1123 | 0        |

|             |         |                  |             |                                                                                                                                                                    |  |      |          |
|-------------|---------|------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|----------|
|             |         |                  | S01991      | transforming protein B-myb                                                                                                                                         |  | 1123 | 0        |
|             |         |                  | CAA31655.1  | B-myb protein (AA 1-700)                                                                                                                                           |  | 1123 | 0        |
|             |         |                  | CAC08392.1  | dJ1028D15.3 (v-myb avian myeloblastosis viral oncogene homolog-like 2)                                                                                             |  | 1123 | 0        |
|             |         |                  | AAH07585.1  | v-myb avian myeloblastosis viral oncogene homolog-like 2                                                                                                           |  | 1123 | 0        |
|             |         |                  | P10243      | MYBA_HUMAN Myb-related protein A (A-Myb)                                                                                                                           |  | 280  | 1.00e-74 |
|             |         |                  | S03423      | transforming protein A-myb                                                                                                                                         |  | 280  | 1.00e-74 |
|             |         |                  | CAA31656.1  | A-myb N-terminal region )2341 is 2nd base in codon)                                                                                                                |  | 280  | 1.00e-74 |
|             |         |                  | AAB49038.1  | alternatively spliced product using exon 9A                                                                                                                        |  | 276  | 1.00e-73 |
|             |         |                  | CAA36371.1  | MYB protein (AA 1-637)                                                                                                                                             |  | 276  | 1.00e-73 |
|             |         |                  | NP_005366.1 | v-myb myeloblastosis viral oncogene homolog (avian); v-myb avian myeloblastosis viral oncogene homolog; Avian myeloblastosis viral (v-myb) oncogene homolog; c-myb |  | 276  | 1.00e-73 |
|             |         |                  | AAA52032.1  | c-myb                                                                                                                                                              |  | 276  | 1.00e-73 |
|             |         |                  | XP_004256.3 | similar to Myb proto-oncogene protein (C-myb)                                                                                                                      |  | 276  | 1.00e-73 |
|             |         |                  | P10242      | MYB_HUMAN Myb proto-oncogene protein (C-myb)                                                                                                                       |  | 276  | 1.00e-73 |
|             |         |                  | AAB49039.1  | c-myb gene product                                                                                                                                                 |  | 276  | 1.00e-73 |
|             |         |                  | AAC96326.1  | MYB proto-oncogene protein                                                                                                                                         |  | 276  | 1.00e-73 |
|             |         |                  | TVHUMB      | transforming protein myb, splice form containing exon 9A                                                                                                           |  | 276  | 1.00e-73 |
|             |         |                  | AAB49035.1  | alternatively spliced product using exon 9B                                                                                                                        |  | 276  | 1.00e-73 |
|             |         |                  | AAB49036.1  | alternatively spliced product using exon 8A                                                                                                                        |  | 276  | 1.00e-73 |
| NM_008168   |         | U:(C-IR)<br>2.99 |             |                                                                                                                                                                    |  |      |          |
|             |         | U:(C-D)<br>2.57  |             |                                                                                                                                                                    |  |      |          |
| NP_032194.1 | Mm.2879 | U:(IR-D)<br>2.41 | Q16478      | GLK5_HUMAN Glutamate receptor, ionotropic kainate 5 precursor (Glutamate receptor KA-2) (KA2) (Excitatory amino acid receptor 2) (EAA2)                            |  | 1757 | 0        |
|             |         |                  | I57936      | glutamate receptor subunit                                                                                                                                         |  | 1757 | 0        |
|             |         |                  | AAB22591.1  | glutamate receptor subunit; EAA2; excitatory amino acid receptor 2                                                                                                 |  | 1757 | 0        |

|             |                  |          |  |             |                                                                                                                                                 |      |   |
|-------------|------------------|----------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|---|
|             |                  |          |  | NP_002079.2 | glutamate receptor, ionotropic, kainate 5                                                                                                       | 1625 | 0 |
|             |                  |          |  | CAC80547.1  | kainate receptor subunit KA2a                                                                                                                   | 1625 | 0 |
|             |                  |          |  | NP_055434.1 | glutamate receptor, ionotropic, kainate 4; excitatory amino acid receptor 1                                                                     | 1254 | 0 |
|             |                  |          |  | Q16099      | GLK4_HUMAN Glutamate receptor, ionotropic kainate 4 precursor (Glutamate receptor KA-1) (KA1) (Excitatory amino acid receptor 1)(EAA1)          | 1254 | 0 |
|             |                  |          |  | JH0826      | glutamate ionotropic receptor EAA1 chain precursor                                                                                              | 1254 | 0 |
|             |                  |          |  | AAB29311.1  | excitatory amino acid receptor 1; kainate receptor subunit EAA1                                                                                 | 1254 | 0 |
|             |                  |          |  | A54260      | glutamate receptor 6 kainate-preferring precursor                                                                                               | 704  | 0 |
|             |                  |          |  | AAB31362.1  | GluR6 kainate receptor=ionotropic-type glutamate receptor                                                                                       | 704  | 0 |
|             |                  |          |  | NP_068775.1 | glutamate receptor, ionotropic, kainate 2                                                                                                       | 704  | 0 |
|             |                  |          |  | Q13002      | GLK2_HUMAN Glutamate receptor, ionotropic kainate 2 precursor (Glutamate receptor 6) (GluR-6) (GluR6) (Excitatory amino acid receptor 4) (EAA4) | 704  | 0 |
|             |                  |          |  | AAC50420.1  | EAA4                                                                                                                                            | 704  | 0 |
|             |                  |          |  | CAC67487.1  | GluR6 kainate receptor                                                                                                                          | 689  | 0 |
|             |                  |          |  | CAC81020.1  | kainate receptor subunit                                                                                                                        | 687  | 0 |
|             |                  |          |  | Q13003      | GLK3_HUMAN Glutamate receptor, ionotropic kainate 3 precursor (Glutamate receptor 7) (GluR-7) (GluR7) (Excitatory amino acid receptor 5) (EAA5) | 687  | 0 |
|             |                  |          |  | NP_000822.1 | glutamate receptor, ionotropic, kainate 3                                                                                                       | 687  | 0 |
|             |                  |          |  | AAB60407.1  | EAA5                                                                                                                                            | 687  | 0 |
|             |                  |          |  | AAA95961.1  | EAA3                                                                                                                                            | 685  | 0 |
| NM_007765   | U:(C-IR)<br>2.93 |          |  |             |                                                                                                                                                 |      |   |
| NP_031791.1 | U:(C-D)<br>2.6   | Mm.22695 |  | NP_001304.1 | collapsin response mediator protein 1; collapsin response mediator protein 1 (dihydropyrimidinase-like 1)                                       | 1036 | 0 |
|             |                  |          |  | Q14194      | DPY1_HUMAN Dihydropyrimidinase related protein-1 (DRP-1) (Collapsin response mediator protein 1) (CRMP-1)                                       | 1036 | 0 |
|             |                  |          |  | JC5316      | dihydropyrimidinase related protein 1                                                                                                           | 1036 | 0 |
|             |                  |          |  | BAA11190.1  | dihydropyrimidinase related protein-1                                                                                                           | 1036 | 0 |

|             |               |  |                  |             |                                                                                                                                                       |  |      |       |
|-------------|---------------|--|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|
|             |               |  |                  | AAH00252.1  | collapsin response mediator protein 1                                                                                                                 |  | 1036 | 0     |
|             |               |  |                  | AAH07613.1  | collapsin response mediator protein 1                                                                                                                 |  | 1036 | 0     |
|             |               |  |                  | AAK55500.1  | collapsin response mediator protein 1                                                                                                                 |  | 963  | 0     |
|             |               |  |                  | AAA93201.1  | hCRMP-1                                                                                                                                               |  | 919  | 0     |
|             |               |  |                  | NP_001377.1 | dihydropyrimidinase-like 2; collapsin response mediator protein hCRMP-2                                                                               |  | 847  | 0     |
|             |               |  |                  | Q16555      | DPY2_HUMAN Dihydropyrimidinase related protein-2 (DRP-2) (Collapsin response mediator protein 2) (CRMP-2) (N2A3)                                      |  | 847  | 0     |
|             |               |  |                  | JC5317      | dihydropyrimidinase-related protein 2                                                                                                                 |  | 847  | 0     |
|             |               |  |                  | AAA93202.1  | hCRMP-2                                                                                                                                               |  | 847  | 0     |
|             |               |  |                  | BAA11191.1  | dihydropyrimidinase related protein-2                                                                                                                 |  | 847  | 0     |
|             |               |  |                  | AAC05793.1  | N2A3                                                                                                                                                  |  | 847  | 0     |
|             |               |  |                  | BAA86991.1  | dihydropyrimidinase related protein 2                                                                                                                 |  | 847  | 0     |
|             |               |  |                  | NP_001378.1 | dihydropyrimidinase-like 3                                                                                                                            |  | 813  | 0     |
|             |               |  |                  | Q14195      | DPY3_HUMAN Dihydropyrimidinase related protein-3 (DRP-3) (Unc-33-like phosphoprotein) (ULIP protein) (Collapsin response mediator protein 4) (CRMP-4) |  | 813  | 0     |
|             |               |  |                  | JC5318      | dihydropyrimidinase related protein 3                                                                                                                 |  | 813  | 0     |
|             |               |  |                  | BAA11192.1  | dihydropyrimidinase related protein-3                                                                                                                 |  | 813  | 0     |
|             |               |  |                  | AAH39006.1  | dihydropyrimidinase-like 3                                                                                                                            |  | 813  | 0     |
|             |               |  |                  | CAA69153.1  | ULIP                                                                                                                                                  |  | 810  | 0     |
|             |               |  |                  | NP_006417.1 | dihydropyrimidinase-like 4                                                                                                                            |  | 781  | 0     |
|             |               |  |                  | O14531      | DPY4_HUMAN Dihydropyrimidinase related protein-4 (DRP-4) (ULIP4 protein)                                                                              |  | 781  | 0     |
|             |               |  |                  | BAA21886.1  | dihydropyrimidinase related protein 4                                                                                                                 |  | 781  | 0     |
|             |               |  |                  | CAA71872.1  | cytosolic phosphoprotein                                                                                                                              |  | 749  | 0     |
|             |               |  |                  | AAH07898.1  | Similar to collapsin response mediator protein 1                                                                                                      |  | 712  | 0     |
| NM_009872   |               |  | U:(C-IR)<br>2.86 |             |                                                                                                                                                       |  |      |       |
| NP_034002.1 | Mm.15383<br>3 |  | U:(C-D)<br>2.61  | NP_003927.1 | cyclin-dependent kinase 5, regulatory subunit 2; cyclin-dependent kinase 5 activator isoform p39i; NEURONAL CDK5 activator isoform                    |  | 483  | e-136 |

|             |         |                  |  |             |                                                                                                                                                                                                                    |     |          |
|-------------|---------|------------------|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |                  |  | Q13319      | CD5S_HUMAN Cyclin-dependent kinase 5 activator 2 precursor (CDK5 activator 2) (Cyclin-dependent kinase 5 regulatory subunit 2) (P39)(P39I)                                                                         | 483 | e-136    |
|             |         |                  |  | I39172      | cyclin-dependent kinase 5 activator isoform p39i                                                                                                                                                                   | 483 | e-136    |
|             |         |                  |  | AAC50278.1  | cyclin-dependent kinase 5 activator isoform p39i                                                                                                                                                                   | 483 | e-136    |
|             |         |                  |  | 2202258A    | cyclin-dependent kinase 5                                                                                                                                                                                          | 483 | e-136    |
|             |         |                  |  | NP_003876.1 | cyclin-dependent kinase 5, regulatory subunit 1; regulatory partner for cdk5 kinase; TPKII regulatory subunit                                                                                                      | 228 | 1.00e-59 |
|             |         |                  |  | Q15078      | CD5R_HUMAN Cyclin-dependent kinase 5 activator 1 precursor (CDK5 activator 1) (Cyclin-dependent kinase 5 regulatory subunit 1) (Tau protein kinase II 23 kDa subunit) (TPKII regulatory subunit) (P23) (P25) (P35) | 228 | 1.00e-59 |
|             |         |                  |  | S50861      | cyclin-dependent kinase 5 regulatory chain p35                                                                                                                                                                     | 228 | 1.00e-59 |
|             |         |                  |  | CAA56587.1  | regulatory partner for cdk5 kinase                                                                                                                                                                                 | 228 | 1.00e-59 |
|             |         |                  |  | AAH20580.1  | AAH20580 cyclin-dependent kinase 5, regulatory subunit 1 (p35)                                                                                                                                                     | 228 | 1.00e-59 |
|             |         |                  |  | 2019431A    | cyclin-dependent kinase 5:SUBUNIT-p35                                                                                                                                                                              | 228 | 1.00e-59 |
|             |         |                  |  | AAH26347.1  | cyclin-dependent kinase 5, regulatory subunit 1 (p35)                                                                                                                                                              | 226 | 4.00e-59 |
|             |         |                  |  | AAH30792.1  | cyclin-dependent kinase 5, regulatory subunit 1 (p35)                                                                                                                                                              | 226 | 4.00e-59 |
|             |         |                  |  | I1H4L       | D Chain D, Structure And Regulation Of The Cdk5-P25(Nck5a) Complex                                                                                                                                                 | 217 | 2.00e-56 |
|             |         |                  |  | I1H4L       | E Chain E, Structure And Regulation Of The Cdk5-P25(Nck5a) Complex                                                                                                                                                 | 217 | 2.00e-56 |
|             |         |                  |  | XP_093388.1 | similar to DnaJ homolog subfamily B member 8 (mDf6)                                                                                                                                                                | 336 | 4.00e-92 |
| NM_019964   |         |                  |  |             |                                                                                                                                                                                                                    |     |          |
| NP_064348.1 | Mm.2039 | U:(C-IR)<br>2.84 |  |             |                                                                                                                                                                                                                    |     |          |
|             | 2       | U:(C-D)<br>3.13  |  |             |                                                                                                                                                                                                                    |     |          |
|             |         |                  |  | NP_699161.1 | hypothetical protein MGC33884                                                                                                                                                                                      | 336 | 4.00e-92 |
|             |         |                  |  | AAH29521.1  | Similar to DnaJ (Hsp40) homolog, subfamily B, member 8                                                                                                                                                             | 336 | 4.00e-92 |
|             |         |                  |  | NP_005485.1 | DnaJ (Hsp40) homolog, subfamily B, member 6 isoform b; Heat shock protein J2                                                                                                                                       | 258 | 7.00e-69 |
|             |         |                  |  | BAA32209.1  | MRJ                                                                                                                                                                                                                | 258 | 7.00e-69 |
|             |         |                  |  | AAD43194.1  | AF075601_1 heat shock J2 protein                                                                                                                                                                                   | 258 | 7.00e-69 |
|             |         |                  |  | AAF21257.1  | AF060703_1 DNAJ homolog                                                                                                                                                                                            | 258 | 7.00e-69 |



|             |          |                  |  |             |                                                                                                                                                                                                          |     |       |          |
|-------------|----------|------------------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|
|             |          |                  |  | BAA88770.1  | DnaJ homolog                                                                                                                                                                                             |     | 258   | 7.00e-69 |
|             |          |                  |  | CAB66642.1  | hypothetical protein                                                                                                                                                                                     |     | 258   | 7.00e-69 |
|             |          |                  |  | AAH00177.1  | Similar to DnaJ (Hsp40) homolog, subfamily B, member 6                                                                                                                                                   |     | 258   | 7.00e-69 |
|             |          |                  |  | XP_052862.4 | similar to DnaJ homolog                                                                                                                                                                                  |     | 256   | 3.00e-68 |
|             |          |                  |  | NP_490647.1 | DnaJ (Hsp40) homolog, subfamily B, member 6 isoform a; Heat shock protein J2                                                                                                                             |     | 249   | 6.00e-66 |
|             |          |                  |  | O75190      | DJB6_HUMAN DnaJ homolog subfamily B member 6 (Heat shock protein J2) (HSJ-2) (MSJ-1) (HHDI1) (MRJ)                                                                                                       |     | 249   | 6.00e-66 |
|             |          |                  |  | BAA88769.1  | DnaJ homolog                                                                                                                                                                                             |     | 249   | 6.00e-66 |
|             |          |                  |  | AAH02446.1  | AAH02446 MRJ gene for a member of the DNAJ protein family                                                                                                                                                |     | 249   | 6.00e-66 |
| NM_008417   |          | U:(C-IR)<br>2.82 |  |             |                                                                                                                                                                                                          |     |       |          |
| NP_032443.1 | Mm.56930 | U:(C-D)<br>2.47  |  | NP_004965.1 | potassium voltage-gated channel, shaker-related subfamily, member 2; voltage-gated potassium channel protein Kv1.2; potassium channel                                                                    | 880 | 0     |          |
|             |          |                  |  | P16389      | CIK2_HUMAN Potassium voltage-gated channel subfamily A member 2 (Potassium channel Kv1.2) (RBK2) (HBK5) (NGK1) (MK2) (HUKIV)                                                                             | 880 | 0     |          |
|             |          |                  |  | I77466      | potassium channel                                                                                                                                                                                        | 880 | 0     |          |
|             |          |                  |  | AAA36141.1  | potassium channel                                                                                                                                                                                        | 880 | 0     |          |
|             |          |                  |  | NP_000208.1 | potassium voltage-gated channel, shaker-related subfamily, member 1                                                                                                                                      | 662 | 0     |          |
|             |          |                  |  | Q09470      | CIK1_HUMAN Potassium voltage-gated channel subfamily A member 1 (Potassium channel Kv1.1) (HUKI) (HBK1)                                                                                                  | 662 | 0     |          |
|             |          |                  |  | I57680      | potassium channel KCNA1                                                                                                                                                                                  | 662 | 0     |          |
|             |          |                  |  | AAA36139.1  | potassium channel                                                                                                                                                                                        | 662 | 0     |          |
|             |          |                  |  |             | potassium voltage-gated channel, shaker-related subfamily, member 3; potassium channel protein; voltage-gated potassium channel; voltage-gated potassium channel protein Kv1.3; type n potassium channel | 600 | e-171 |          |
|             |          |                  |  | NP_002223.2 |                                                                                                                                                                                                          |     |       |          |
|             |          |                  |  | P22001      | CIK3_HUMAN Potassium voltage-gated channel subfamily A member 3 (Potassium channel Kv1.3) (HPCN3) (HGK5) (HUKIII) (HLK3)                                                                                 | 600 | e-171 |          |
|             |          |                  |  | AAB88073.1  | voltage-gated potassium channel                                                                                                                                                                          | 600 | e-171 |          |
|             |          |                  |  | AAH35059.1  | potassium voltage-gated channel, shaker-related subfamily, member 3                                                                                                                                      | 600 | e-171 |          |

|             |         |                  |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |
|-------------|---------|------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|             |         |                  | A38101      | potassium channel KCNA3                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 599 | e-171 |
|             |         |                  | AAA59457.1  | potassium channel protein                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 599 | e-171 |
|             |         |                  | AAC31761.1  | potassium channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 598 | e-171 |
|             |         |                  | AAA36425.1  | potassium channel protein                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 595 | e-170 |
|             |         |                  |             | potassium voltage-gated channel, shaker-related subfamily, member 4; potassium voltage-gated channel, shaker-related subfamily, member 4-like; potassium channel KCNA4; shaker-related potassium channel Kv1.4; voltage-gated potassium channel; potassium channel protein; type A potassium channel; rapidly inactivating potassium channel; fetal skeletal muscle potassium channel; cardiac potassium channel; potassium channel 2; voltage-gated potassium channel protein Kv1.4 | 543 | e-154 |
|             |         |                  | NP_002224.1 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |
|             |         |                  | A39922      | potassium channel KCNA4                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 543 | e-154 |
|             |         |                  | AAA36140.1  | potassium channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 543 | e-154 |
|             |         |                  | AAA61275.1  | voltage-gated potassium channel                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 543 | e-154 |
|             |         |                  | P22459      | CIK4_HUMAN Potassium voltage-gated channel subfamily A member 4 (Potassium channel Kv1.4) (HK1) (HPCN2) (HBK4) (HUKII)                                                                                                                                                                                                                                                                                                                                                               | 541 | e-153 |
|             |         |                  | AAA60034.1  | potassium channel protein                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 541 | e-153 |
|             |         |                  |             | potassium voltage-gated channel, shaker-related subfamily, member 6; voltage-gated potassium channel protein Kv1.6; human brain potassium channel-2                                                                                                                                                                                                                                                                                                                                  | 519 | e-147 |
|             |         |                  | NP_002226.1 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |
|             |         |                  | P17658      | CIK6_HUMAN Potassium voltage-gated channel subfamily A member 6 (Potassium channel Kv1.6) (HBK2)                                                                                                                                                                                                                                                                                                                                                                                     | 519 | e-147 |
|             |         |                  | CAA35623.1  | put. HBK2 protein (AA 1-529)                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 519 | e-147 |
|             |         |                  | S12787      | potassium channel KCNA2                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 517 | e-146 |
|             |         |                  | NP_000757.2 | cytochrome P450, subfamily IIA (phenobarbital-inducible), polypeptide 13                                                                                                                                                                                                                                                                                                                                                                                                             | 563 | e-160 |
| NM_013809   | Mm.1023 | U:(C-IR)<br>2.79 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |
| NP_038837.1 | 12      | U:(C-D)<br>2.22  |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |
|             |         |                  | AAG35775.1  | cytochrome P450 2A13                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 563 | e-160 |
|             |         |                  | Q16696      | CPAD_HUMAN Cytochrome P450 2A13 (CYPIIA13)                                                                                                                                                                                                                                                                                                                                                                                                                                           | 558 | e-158 |
|             |         |                  | AAB40519.1  | cytochrome P450                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 558 | e-158 |

|                          |  |                                    |  |             |                                                                                                                                                                                                                                       |      |       |
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|                          |  |                                    |  | O4HUA6      | coumarin 7-hydroxylase (EC 1.14.14.-) cytochrome P450 2A6                                                                                                                                                                             | 555  | e-158 |
|                          |  |                                    |  | AAA52067.1  | cytochrome P450IIA3                                                                                                                                                                                                                   | 555  | e-158 |
|                          |  |                                    |  | NP_000753.2 | cytochrome P450, subfamily IIA (phenobarbital-inducible), polypeptide 6; coumarin 7-hydroxylase; cytochrome P450, subfamily IIA (phenobarbital-inducible), polypeptide 3; xenobiotic monooxygenase; flavoprotein-linked monooxygenase | 553  | e-157 |
|                          |  |                                    |  | P11509      | CPA6 HUMAN Cytochrome P450 2A6 (CYPIIA6) (Coumarin 7-hydroxylase) (IIA3) (CYP2A3) (P450(I))                                                                                                                                           | 552  | e-157 |
|                          |  |                                    |  | CAA32118.1  | P-450 IIA4 protein (AA 1-494)                                                                                                                                                                                                         | 552  | e-157 |
|                          |  |                                    |  | AAF13600.1  | AF182275_1 cytochrome P450-2A6                                                                                                                                                                                                        | 551  | e-157 |
|                          |  |                                    |  | 1609083A    | cytochrome P450IIA                                                                                                                                                                                                                    | 551  | e-156 |
|                          |  |                                    |  | CAA32097.1  | cytochrome P-450IIA (AA 1 - 489)                                                                                                                                                                                                      | 551  | e-156 |
|                          |  |                                    |  | P20853      | CPA7_HUMAN Cytochrome P450 2A7 (CYPIIA7) (P450-IIA4)                                                                                                                                                                                  | 543  | e-154 |
|                          |  |                                    |  | AAA52138.1  | cytochrome P450IIA4                                                                                                                                                                                                                   | 543  | e-154 |
|                          |  |                                    |  | C34271      | cytochrome P450 2A4                                                                                                                                                                                                                   | 543  | e-154 |
| NM_017402<br>NP_059098.1 |  | U:(C-IR)<br>2.74<br>U:(C-D)<br>2.8 |  | NP_003890.1 | Rho guanine nucleotide exchange factor 7 isoform a; SH3 domain-containing proline-rich protein; PAK-interacting exchange factor beta                                                                                                  | 1135 | 0     |
|                          |  |                                    |  | Q14155      | PIXB_HUMAN Rho guanine nucleotide exchange factor 7 (PAK-interacting exchange factor beta) (Beta-Pix) (COOL-1) (p85)                                                                                                                  | 1135 | 0     |
|                          |  |                                    |  | BAA09763.1  | The KIAA0142 gene is related to human KIAA0006 gene.                                                                                                                                                                                  | 1135 | 0     |
|                          |  |                                    |  | CAD38906.1  | hypothetical protein                                                                                                                                                                                                                  | 1014 | 0     |
|                          |  |                                    |  | NP_663788.1 | Rho guanine nucleotide exchange factor 7 isoform b; SH3 domain-containing proline-rich protein; PAK-interacting exchange factor beta                                                                                                  | 1014 | 0     |
|                          |  |                                    |  | BAA04985.1  | this sequence overlaps D13631, it covers 954..4359 of this sequence.                                                                                                                                                                  | 751  | 0     |
|                          |  |                                    |  | XP_042963.2 | similar to Rho guanine nucleotide exchange factor 6 (PAK-interacting exchange factor alpha) (Alpha-Pix) (COOL-2)                                                                                                                      | 751  | 0     |

|             |                 |          |             |                                                                                                                                                                             |      |          |
|-------------|-----------------|----------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |                 |          | NP_004831.1 | Rac/Cdc42 guanine nucleotide exchange factor 6; PAK-interacting exchange factor, alpha; Rac/Cdc42 guanine exchange factor (GEF) 6; rho guanine nucleotide exchange factor 6 | 751  | 0        |
|             |                 |          | Q15052      | ARH6_HUMAN Rho guanine nucleotide exchange factor 6 (PAK-interacting exchange factor alpha) (Alpha-Pix) (COOL-2)                                                            | 751  | 0        |
|             |                 |          | AAH39856.1  | Rac/Cdc42 guanine nucleotide exchange factor (GEF) 6                                                                                                                        | 751  | 0        |
|             |                 |          | BAA02796.1  | KIAA0006                                                                                                                                                                    | 504  | e-142    |
|             |                 |          | 1BY1        | A Chain A, Dbl Homology Domain From Beta-Pix                                                                                                                                | 385  | e-106    |
|             |                 |          | AAH33768.1  | Similar to Rac/Cdc42 guanine nucleotide exchange factor (GEF) 6                                                                                                             | 301  | 4.00e-81 |
| NM_009819   | U:(C-IR)<br>2.7 |          |             | catenin (cadherin-associated protein), alpha 2; Catenin, alpha-2(cadherin-associated protein, related)                                                                      |      |          |
| NP_033949.1 | U:(C-D)<br>2.71 | Mm.34637 | NP_004380.1 | CTN2_HUMAN Alpha-2 catenin (Alpha-catenin related protein) (Alpha N-catenin)                                                                                                | 1684 | 0        |
|             |                 |          | P26232      | CTN2_HUMAN Alpha-2 catenin (Alpha-catenin related protein) (Alpha N-catenin)                                                                                                | 1684 | 0        |
|             |                 |          | AAA58407.2  | cadherin-associated protein-related                                                                                                                                         | 1684 | 0        |
|             |                 |          | A45011      | alpha-catenin 2                                                                                                                                                             | 1317 | 0        |
|             |                 |          | XP_038221.1 | similar to Alpha-1 catenin (Cadherin-associated protein) (AlphaE-catenin)                                                                                                   | 1317 | 0        |
|             |                 |          | P35221      | CTN1_HUMAN Alpha-1 catenin (Cadherin-associated protein) (Alpha E-catenin)                                                                                                  | 1317 | 0        |
|             |                 |          | N0607       | alpha-catenin 1                                                                                                                                                             | 1317 | 0        |
|             |                 |          | BAA02979.1  | alpha-catenin                                                                                                                                                               | 1317 | 0        |
|             |                 |          | AAC99459.1  | alphaE-catenin                                                                                                                                                              | 1317 | 0        |
|             |                 |          | AAH00385.1  | Unknown (protein for MGC:8429)                                                                                                                                              | 1317 | 0        |
|             |                 |          | BAA03530.1  | 'human alpha-catenin'                                                                                                                                                       | 1313 | 0        |
|             |                 |          | 2023176A    | alpha catenin                                                                                                                                                               | 1313 | 0        |
|             |                 |          | JC2542      | alpha-2(E)-catenin                                                                                                                                                          | 1290 | 0        |
|             |                 |          | AAA18949.1  | alpha2(E)-catenin                                                                                                                                                           | 1290 | 0        |
|             |                 |          | NP_001894.1 | catenin (cadherin-associated protein), alpha 1, 102kDa; catenin (cadherin-associated protein), alpha 1 (102kD); catenin (cadherin-associated protein), alpha 1 (102kDa)     | 1286 | 0        |

|             |         |          |             |                                                                                                                                                                                                                                        |  |      |          |
|-------------|---------|----------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|----------|
|             |         |          | AAA86430.1  | alpha1(E)-catenin                                                                                                                                                                                                                      |  | 1286 | 0        |
|             |         |          | NP_037398.1 | alpha-catenin-like protein                                                                                                                                                                                                             |  | 974  | 0        |
|             |         |          | AAF21801.1  | AF091606_1 alphaT-catenin                                                                                                                                                                                                              |  | 974  | 0        |
|             |         |          | AAH31262.1  | Similar to catenin (cadherin-associated protein), alpha 2                                                                                                                                                                              |  | 841  | 0        |
|             |         |          | 1H6G        | A Chain A, Alpha-Catenin M-Domain                                                                                                                                                                                                      |  | 389  | e-107    |
|             |         |          | 1H6G        | B Chain B, Alpha-Catenin M-Domain                                                                                                                                                                                                      |  | 389  | e-107    |
|             |         |          | XP_068797.2 | similar to alpha(E)-catenin                                                                                                                                                                                                            |  | 380  | e-105    |
| NM_010437   | Mm.4215 | U:(C-IR) | NP_006725.2 | human immunodeficiency virus type I enhancer binding protein 2; human immunodeficiency virus type I enhancer-binding protein 2                                                                                                         |  | 3799 | 0        |
| NP_034567.1 | 7       | 2.68     | WMHUE2      | HIV-EP2 enhancer-binding protein                                                                                                                                                                                                       |  | 3799 | 0        |
|             |         |          | CAA46596.1  | MBP-2 (MHC Binding Protein-2)                                                                                                                                                                                                          |  | 3799 | 0        |
|             |         |          | AAF81365.1  | human immunodeficiency virus type I enhancer-binding protein 2                                                                                                                                                                         |  | 3797 | 0        |
|             |         |          | P31629      | ZEP2_HUMAN HUMAN IMMUNODEFICIENCY VIRUS TYPE I ENHANCER-BINDING PROTEIN 2 (HIV-EP2)                                                                                                                                                    |  | 2698 | 0        |
|             |         |          | AAB88218.1  | HIV-EP2/Schnurri-2                                                                                                                                                                                                                     |  | 2698 | 0        |
|             |         |          | NP_078779.1 | human immunodeficiency virus type I enhancer-binding protein 3                                                                                                                                                                         |  | 786  | 0        |
|             |         |          | AAK01082.1  | AF278765_1 kappa B and V(D)J recombination signal sequences binding protein                                                                                                                                                            |  | 786  | 0        |
|             |         |          | BAB13381.1  | KIAA1555 protein                                                                                                                                                                                                                       |  | 486  | e-136    |
|             |         |          | NP_002105.1 | human immunodeficiency virus type I enhancer binding protein 1; human immunodeficiency virus type I enhancer-binding protein 1                                                                                                         |  | 257  | 2.00e-67 |
|             |         |          | P15822      | ZEP1_HUMAN Zinc finger protein 40 (Human immunodeficiency virus type I enhancer-binding protein 1) (HIV-EP1) (Major histocompatibility complex binding protein 1) (MBP-1) (Positive regulatory domain II binding factor 1) (PRDII-BF1) |  | 257  | 2.00e-67 |
|             |         |          | A34203      | DNA-binding protein PRDII-BF1                                                                                                                                                                                                          |  | 257  | 2.00e-67 |
|             |         |          | CAA35798.1  | PRDII-BF1 protein (AA 1-2717)                                                                                                                                                                                                          |  | 257  | 2.00e-67 |
|             |         |          | AAA17534.1  | DNA-binding protein                                                                                                                                                                                                                    |  | 250  | 2.00e-65 |

|             |          |                  |  |  |             |                                                                                                           |      |          |
|-------------|----------|------------------|--|--|-------------|-----------------------------------------------------------------------------------------------------------|------|----------|
| AK003722    |          | U:(C-IR)<br>2.62 |  |  |             |                                                                                                           |      |          |
| BAB22959.1  | Mm.89830 | U:(C-D)<br>2.18  |  |  | NP_008950.1 | ubiquitin-conjugating enzyme E2C; ubiquitin carrier protein E2-C                                          | 343  | 2.00e-94 |
|             |          |                  |  |  | O00762      | UBCC_HUMAN Ubiquitin-conjugating enzyme E2 C (Ubiquitin-protein ligase C) (UbcH10)                        | 343  | 2.00e-94 |
|             |          |                  |  |  | AAB53362.1  | cyclin-selective ubiquitin carrier protein                                                                | 343  | 2.00e-94 |
|             |          |                  |  |  | CAB66118.1  | ubiquitin-conjugating enzyme E2 H10 (isoform 1)                                                           | 343  | 2.00e-94 |
|             |          |                  |  |  | AAH07656.1  | ubiquitin carrier protein E2-C                                                                            | 343  | 2.00e-94 |
|             |          |                  |  |  | AAH16292.1  | ubiquitin-conjugating enzyme E2C                                                                          | 343  | 2.00e-94 |
| NM_007511   |          |                  |  |  |             |                                                                                                           |      |          |
| NP_031537.1 | Mm.87854 | U:(C-IR)<br>2.62 |  |  | AAB52902.1  | AAB52902.1                                                                                                | 2285 | 0        |
|             |          |                  |  |  | NP_000044.1 | ATPase, Cu++ transporting, beta polypeptide (Wilson disease); ATPase, Cu++ transporting, beta polypeptide | 2282 | 0        |
|             |          |                  |  |  | P35670      | AT7B_HUMAN Copper-transporting ATPase 2 (Copper pump 2) (Wilson disease-associated protein)               | 2282 | 0        |
|             |          |                  |  |  | S78555      | copper-transporting ATPase (EC 3.6.1.-) beta                                                              | 2282 | 0        |
|             |          |                  |  |  | AAA92667.1  | copper transporting ATPase                                                                                | 2282 | 0        |
|             |          |                  |  |  | 2001422A    | Cu transporting ATPase P                                                                                  | 2149 | 0        |
|             |          |                  |  |  | S40525      | copper-transporting ATPase (EC 3.6.1.-) beta chain                                                        | 2149 | 0        |
|             |          |                  |  |  | Q04656      | AT7A_HUMAN Copper-transporting ATPase 1 (Copper pump 1) (Menkes disease-associated protein)               | 1484 | 0        |
|             |          |                  |  |  | S36149      | copper-transporting ATPase (EC 3.6.1.-) alpha chain                                                       | 1484 | 0        |
|             |          |                  |  |  | CAB94714.1  | Menkes disease                                                                                            | 1484 | 0        |
|             |          |                  |  |  | NP_000043.1 | ATPase, Cu++ transporting, alpha polypeptide                                                              | 1484 | 0        |
|             |          |                  |  |  | AAA35580.1  | Cu++-transporting P-type ATPase                                                                           | 1484 | 0        |
|             |          |                  |  |  | AAA96010.1  | Menkes disease gene                                                                                       | 1467 | 0        |
|             |          |                  |  |  | CAB08162.2  | Menkes Disease (ATP7A)                                                                                    | 1420 | 0        |

|             |          |                  |             |                                                                                                                                              |     |          |       |
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|             |          |                  | AAA79212.1  | ORF                                                                                                                                          |     | 1022     | 0     |
|             |          |                  | AAA16173.1  | Wilson disease-associated protein                                                                                                            |     | 608      | e-173 |
| NM_008356   |          | U:(C-IR)<br>2.61 |             |                                                                                                                                              |     |          |       |
| NP_032382.1 | Mm.20855 | U:(C-D)<br>2.38  |             | interleukin 13 receptor, alpha 2 precursor; interleukin 13 binding protein; interleukin 13 receptor alpha 2 chain; IL-13 receptor            |     |          |       |
|             |          |                  | NP_000631.1 |                                                                                                                                              | 431 | e-120    |       |
|             |          |                  | Q14627      | I132_HUMAN Interleukin-13 receptor alpha-2 chain precursor (Interleukin-13 binding protein)                                                  | 431 | e-120    |       |
|             |          |                  | CAA64617.1  | interleukin 13 receptor                                                                                                                      | 431 | e-120    |       |
|             |          |                  | AAB17170.1  | interleukin-13 receptor                                                                                                                      | 431 | e-120    |       |
|             |          |                  | CAA70021.1  | IL-13 receptor                                                                                                                               | 431 | e-120    |       |
|             |          |                  | CAD18962.1  | dA204F4.1 (interleukin 13 receptor, alpha 2)                                                                                                 | 431 | e-120    |       |
|             |          |                  | AAH20739.1  | interleukin 13 receptor, alpha 2                                                                                                             | 431 | e-120    |       |
|             |          |                  | AAH33705.1  | interleukin 13 receptor, alpha 2                                                                                                             | 431 | e-120    |       |
|             |          |                  | AAG17965.1  | AF089087_1 G protein-coupled receptor                                                                                                        | 411 | e-114    |       |
| NM_022320   | Mm.1527  | U:(C-IR)<br>2.59 |             |                                                                                                                                              |     |          |       |
| NP_071715.1 | 80       | U:(C-D)<br>3.35  |             |                                                                                                                                              |     |          |       |
|             |          | U:(IR-D)<br>2.3  |             |                                                                                                                                              |     |          |       |
|             |          |                  | NP_005292.1 | G protein-coupled receptor 35                                                                                                                | 409 | e-113    |       |
|             |          |                  | Q9HC97      | GP35_HUMAN Probable G protein-coupled receptor GPR35                                                                                         | 409 | e-113    |       |
|             |          |                  | AAC52028.1  | G protein-coupled receptor                                                                                                                   | 409 | e-113    |       |
|             |          |                  |             |                                                                                                                                              |     |          |       |
| NM_010174   | Mm.2222  | U:(C-IR)<br>2.54 | CAA71305.1  | mammary-derived growth inhibitor                                                                                                             | 241 | 5.00e-64 |       |
| NP_034304.1 | 0        |                  |             |                                                                                                                                              |     |          |       |
|             |          |                  | NP_004093.1 | fatty acid binding protein 3                                                                                                                 | 240 | 1.00e-63 |       |
|             |          |                  | XP_049316.1 | similar to Fatty acid-binding protein, heart (H-FABP) (Muscle fatty acid-binding protein) (M-FABP) (Mammary-derived growth inhibitor) (MDGI) | 240 | 1.00e-63 |       |

|             |         |                  |             |                                                                                                                                              |      |          |
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|             |         |                  | P05413      | FABH_HUMAN Fatty acid-binding protein, heart (H-FABP) (Muscle fatty acid-binding protein) (M-FABP) (Mammary-derived growth inhibitor) (MDGI) | 240  | 1.00e-63 |
|             |         |                  | FZHUC       | fatty acid-binding protein, cardiac and skeletal muscle - human                                                                              | 240  | 1.00e-63 |
|             |         |                  | CAA39889.1  | muscle fatty-acid-binding protein (FABP)                                                                                                     | 240  | 1.00e-63 |
|             |         |                  | AAB02555.1  | fatty acid binding protein FABP                                                                                                              | 240  | 1.00e-63 |
|             |         |                  | AAC99800.1  | fatty acid binding protein                                                                                                                   | 240  | 1.00e-63 |
|             |         |                  | AAH07021.1  | AAH07021 fatty acid binding protein 3, muscle and heart (mammary-derived growth inhibitor)                                                   | 240  | 1.00e-63 |
|             |         |                  | 1G5W        | A Chain A, Solution Structure Of Human Heart-Type Fatty Acid Binding Protein                                                                 | 238  | 6.00e-63 |
|             |         |                  | 1HMR        | Fatty Acid Binding Protein (Human Muscle, M-Fabp) Complexed With One Molecule Of Elaidic Acid                                                | 238  | 6.00e-63 |
|             |         |                  | 1HMS        | Fatty Acid Binding Protein (Human Muscle, M-Fabp) Complexed With One Molecule Of Elaidic Acid                                                | 238  | 6.00e-63 |
|             |         |                  | 1HMT        | Fatty Acid Binding Protein (Human Muscle, M-Fabp) Complexed With One Molecule Of Elaidic Acid                                                | 238  | 6.00e-63 |
|             |         |                  | 2HMB        | Fatty Acid Binding Protein (Holo Form, Human Muscle) (M-Fabp)                                                                                | 238  | 6.00e-63 |
|             |         |                  | 1714345A    | fatty acid-binding protein                                                                                                                   | 237  | 1.00e-62 |
|             |         |                  | AAB29294.1  | heart fatty acid binding protein; hFABP                                                                                                      | 214  | 9.00e-56 |
| NM_007634   |         | U:(C-IR)<br>2.52 |             |                                                                                                                                              |      |          |
| NP_031660.1 | Mm.4008 | U:(C-D)<br>2.12  |             |                                                                                                                                              |      |          |
|             |         |                  | AAB60342.1  | cyclin F                                                                                                                                     | 1206 | 0        |
|             |         |                  | P41002      | CG2F_HUMAN G2/mitotic-specific cyclin F                                                                                                      | 1205 | 0        |
|             |         |                  | AAH12349.1  | cyclin F                                                                                                                                     | 1205 | 0        |
|             |         |                  | NP_001752.1 | cyclin F; G2/mitotic-specific cyclin F; F-box only protein 1                                                                                 | 1197 | 0        |
|             |         |                  | A55501      | cyclin F                                                                                                                                     | 1197 | 0        |
|             |         |                  | CAA85308.1  | cyclin F [Homo sapiens]                                                                                                                      | 1197 | 0        |



|             |              |                                     |             |                                                                                                                                                                                                                |      |          |
|-------------|--------------|-------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| NM_011837   |              | U:(C-IR)<br>2.5                     | NP_002338.1 | lymphocyte antigen 6 complex, locus H                                                                                                                                                                          | 209  | 2.00e-54 |
| NP_035967.1 | Mm.2215<br>4 | U:(C-D)<br>2.69<br>U:(IR-D)<br>2.06 |             |                                                                                                                                                                                                                |      |          |
|             |              |                                     | O94772      | LY6H_HUMAN Lymphocyte antigen Ly-6H precursor                                                                                                                                                                  | 209  | 2.00e-54 |
|             |              |                                     | BAA34115.1  | Ly-6 gene family--another possible initiation codon is at nt position (162..164)                                                                                                                               | 209  | 2.00e-54 |
|             |              |                                     | AAH28894.1  | lymphocyte antigen 6 complex, locus H                                                                                                                                                                          | 209  | 2.00e-54 |
|             |              |                                     | AAH30192.1  | lymphocyte antigen 6 complex, locus H                                                                                                                                                                          | 209  | 2.00e-54 |
| NM_021050   | Mm.1562      | U:(C-IR)<br>2.5<br>U:(C-D)<br>2.36  | P13569      | CFTR_HUMAN Cystic fibrosis transmembrane conductance regulator (CFTR) (cAMP-dependent chloride channel)                                                                                                        | 2207 | 0        |
| NP_066388.1 | 1            |                                     |             |                                                                                                                                                                                                                |      |          |
|             |              |                                     | DVHUCF      | cystic fibrosis transmembrane conductance regulator                                                                                                                                                            | 2207 | 0        |
|             |              |                                     | AAC13657.1  | cystic fibrosis transmembrane conductance regulator                                                                                                                                                            | 2207 | 0        |
|             |              |                                     | NP_000483.2 | cystic fibrosis transmembrane conductance regulator, ATP-binding cassette (sub-family C, member 7); cystic fibrosis transmembrane conductance regulator; ATP-binding cassette, sub-family C member 7; CFTR/MRP | 2202 | 0        |
|             |              |                                     | AAA35680.1  | cystic fibrosis transmembrane conductance regulator                                                                                                                                                            | 2202 | 0        |
|             |              |                                     | AAB46352.1  | transmembrane chloride conductor protein                                                                                                                                                                       | 1523 | 0        |
|             |              |                                     | AAB46340.1  | cystic fibrosis transmembrane conductance regulator                                                                                                                                                            | 687  | 0        |
|             |              |                                     | AAB46341.1  | coded for by human cDNA M96936 (NID:g180293)                                                                                                                                                                   | 630  | e-180    |
|             |              |                                     | AAH41560.1  | Similar to ATP-binding cassette, sub-family C (CFTR/MRP), member 4                                                                                                                                             | 402  | e-111    |
|             |              |                                     | AAN17334.1  | ATP-binding cassette protein C4 splice variant A                                                                                                                                                               | 402  | e-111    |
|             |              |                                     | AAL88745.1  | multidrug resistance-associated protein                                                                                                                                                                        | 402  | e-111    |
|             |              |                                     | NP_005836.1 | ATP-binding cassette, sub-family C, member 4; canalicular multispecific organic anion transporter (ABC superfamily)                                                                                            | 402  | e-111    |
|             |              |                                     | O15439      | MRP4_HUMAN Multidrug resistance-associated protein 4 (MRP/cMOAT-related ABC transporter) (Multi-specific organic anion transporter-B) (MOAT-B)                                                                 | 402  | e-111    |

|             |               |                  |  |             |                                                                                                                                 |      |          |
|-------------|---------------|------------------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |               |                  |  | AAC27076.1  | ABC transporter MOAT-B                                                                                                          | 402  | e-111    |
|             |               |                  |  | AAC27077.1  | ABC transporter MOAT-B isoform                                                                                                  | 353  | 2.00e-96 |
| AF363457    |               | U:(C-IR)<br>2.5  |  |             |                                                                                                                                 |      |          |
| AAK60137.1  | Mm.13083<br>2 | U:(C-D)<br>2.33  |  | NP_077015.1 | caspase recruitment domain protein 14 isoform 1; CARD-containing                                                                | 1257 | 0        |
|             |               |                  |  | Q9BXL6      | CARE_HUMAN Caspase recruitment domain protein 14 (CARD-containing<br>MAGUK protein                                              | 1257 | 0        |
|             |               |                  |  | AAG53403.1  | AF322642_1 caspase recruitment domain protein 14                                                                                | 1257 | 0        |
|             |               |                  |  | AAK54453.1  | CARD-containing MAGUK 2 protein                                                                                                 | 1257 | 0        |
|             |               |                  |  | AAH18142.1  | Similar to caspase recruitment domain protein 14                                                                                | 953  | 0        |
|             |               |                  |  | NP_438170.1 | caspase recruitment domain protein 14 isoform 2; CARD-containing                                                                | 407  | e-113    |
|             |               |                  |  | AAH01326.1  | Unknown (protein for MGC:5551)                                                                                                  | 407  | e-113    |
|             |               |                  |  | Q9BXL7      | CARB_HUMAN Caspase recruitment domain protein 11 (CARD-containing<br>MAGUK protein                                              | 202  | 3.00e-51 |
|             |               |                  |  | AAG53402.1  | AF322641_1 caspase recruitment domain protein 11                                                                                | 202  | 3.00e-51 |
|             |               |                  |  | NP_115791.2 | caspase recruitment domain family, member 11; card-maguk protein 1;                                                             | 202  | 3.00e-51 |
|             |               |                  |  | AAL34460.1  | AF352576_1 CARD-containing MAGUK protein CARMA1                                                                                 | 202  | 3.00e-51 |
|             |               |                  |  | BAB84875.1  | FLJ00120 protein                                                                                                                | 202  | 3.00e-51 |
| NM_009203   |               | U:(C-IR)<br>2.49 |  |             |                                                                                                                                 |      |          |
| NP_033229.1 | Mm.12846      | U:(C-D)<br>2.42  |  | P_653186.2  | urate anion exchanger 1 isoform a; organic anion transporter 4-like; urate transporter<br>1; solute carrier family 22 member 12 | 780  | 0        |
|             |               |                  |  | AAK68156.1  | AC044790_3 RST                                                                                                                  | 780  | 0        |
|             |               |                  |  | BAB96750.1  | URAT1                                                                                                                           | 780  | 0        |
|             |               |                  |  | BAB68364.1  | organic anion transporter 4 like protein                                                                                        | 688  | 0        |
|             |               |                  |  | NP_060954.1 | solute carrier family 22 member 11; organic anion transporter 4                                                                 | 502  | e-142    |
|             |               |                  |  | BAA95316.1  | organic anion transporter 4                                                                                                     | 502  | e-142    |
|             |               |                  |  | AAK68155.1  | AC044790_2 OAT4                                                                                                                 | 502  | e-142    |

|                          |              |                  |  |             |                                                                                                                                          |     |          |
|--------------------------|--------------|------------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |              |                  |  | AAH34384.1  | solute carrier family 22 (organic anion/cation transporter), member 11                                                                   | 502 | e-142    |
|                          |              |                  |  | NP_695008.1 | solute carrier family 22 member 6 isoform b; renal organic anion transporter 1; para-aminohippurate transporter                          | 457 | e-128    |
|                          |              |                  |  | AAD19356.1  | organic anion transporter 1                                                                                                              | 457 | e-128    |
|                          |              |                  |  | BAA75073.1  | hOAT1-2                                                                                                                                  | 457 | e-128    |
|                          |              |                  |  | AAD55356.1  | AF124373_1 organic anion transporter 1                                                                                                   | 457 | e-128    |
|                          |              |                  |  | AAH33682.1  | solute carrier family 22 (organic anion transporter), member 6                                                                           | 457 | e-128    |
|                          |              |                  |  | AAC70004.1  | putative renal organic anion transporter 1                                                                                               | 457 | e-128    |
|                          |              |                  |  | NP_004781.2 | solute carrier family 22 member 6 isoform a; renal organic anion transporter 1; para-aminohippurate transporter                          | 456 | e-128    |
|                          |              |                  |  | BAA75072.1  | hOAT1-1                                                                                                                                  | 456 | e-128    |
|                          |              |                  |  | CAB77184.1  | organic anion transporter                                                                                                                | 456 | e-128    |
|                          |              |                  |  | AAD10052.1  | para-aminohippurate transporter                                                                                                          | 455 | e-128    |
|                          |              |                  |  | NP_700357.1 | NP_700357.1 urate anion exchanger 1 isoform b; organic anion transporter 4-like; urate transporter 1; solute carrier family 22 member 12 | 434 | e-121    |
|                          |              |                  |  | NP_695011.1 | solute carrier family 22 member 6 isoform e; renal organic anion transporter 1; para-aminohippurate transporter                          | 428 | e-119    |
|                          |              |                  |  | BAB47393.1  | organic anion transporter 3                                                                                                              | 418 | e-116    |
| NM_023434<br>NP_075923.1 | Mm.2855<br>3 | U:(C-IR)<br>2.47 |  | NP_055643.1 | KIAA0737 gene product                                                                                                                    | 891 | 0        |
|                          |              |                  |  | BAA34457.1  | KIAA0737 protein                                                                                                                         | 891 | 0        |
|                          |              |                  |  | AAH13689.1  | AAH13689 KIAA0737 gene product                                                                                                           | 891 | 0        |
|                          |              |                  |  | XP_049037.5 | similar to CAGF9                                                                                                                         | 241 | 4.00e-63 |
|                          |              |                  |  |             |                                                                                                                                          |     |          |
|                          |              |                  |  |             |                                                                                                                                          |     |          |



|  |  |                  |             |                                                                                                        |     |          |
|--|--|------------------|-------------|--------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |                  | AAH10425.1  | AAH10425 Unknown (protein for MGC:15225)                                                               | 531 | e-150    |
|  |  |                  | AAA18595.1  | peroxisomal fatty acyl-coA oxidase                                                                     | 530 | e-150    |
|  |  |                  | NP_009223.1 | acyl-Coenzyme A oxidase isoform b; acyl-coenzyme A oxidase I                                           | 526 | e-149    |
|  |  |                  | A54942      | acyl-CoA oxidase (EC 1.3.3.6), peroxisomal splice form I                                               | 526 | e-149    |
|  |  |                  | AAA19113.1  | acyl-CoA oxidase                                                                                       | 526 | e-149    |
|  |  |                  | NP_004026.1 | acyl-Coenzyme A oxidase isoform a; acyl-coenzyme A oxidase I                                           | 523 | e-148    |
|  |  |                  | B54942      | acyl-CoA oxidase (EC 1.3.3.6), peroxisomal splice form II                                              | 523 | e-148    |
|  |  |                  | AAA19114.1  | acyl-CoA oxidase                                                                                       | 523 | e-148    |
|  |  |                  | NP_003492.1 | acyl-Coenzyme A oxidase 3, pristanoyl                                                                  | 268 | 2.00e-71 |
|  |  |                  | O15254      | CAO3_HUMAN Acyl-coenzyme A oxidase 3, peroxisomal (Pristanoyl-CoA oxidase)                             | 268 | 2.00e-71 |
|  |  |                  | CAA72214.1  | pristanoyl-CoA oxidase                                                                                 | 268 | 2.00e-71 |
|  |  | U:(C-IR)<br>2.42 | NP_001731.1 | calbindin 2 full length protein isoform; calbindin 2, (29kD, calretinin); calbindin D29K               | 371 | e-102    |
|  |  |                  | P22676      | CLB2_HUMAN Calretinin (CR) (29 kDa calbindin)                                                          | 371 | e-102    |
|  |  |                  | A60253      | calretinin                                                                                             | 371 | e-102    |
|  |  |                  | CAA39991.1  | calretinin                                                                                             | 371 | e-102    |
|  |  |                  | I709139B    | calretinin                                                                                             | 371 | e-102    |
|  |  |                  | AAH15484.1  | AAH15484 calbindin 2, (29kD, calretinin)                                                               | 371 | e-102    |
|  |  |                  | NP_004920.1 | calbindin 1; calbindin 1, (28kD)                                                                       | 249 | 5.00e-66 |
|  |  |                  | P05937      | CABV_HUMAN Calbindin (Vitamin D-dependent calcium-binding protein, avian-type) (Calbindin D28) (D-28K) | 249 | 5.00e-66 |
|  |  |                  | S00234      | calcium-binding protein, vitamin D-dependent                                                           | 249 | 5.00e-66 |
|  |  |                  | CAA29860.1  | calbindin (AA 1-261)                                                                                   | 249 | 5.00e-66 |
|  |  |                  | AAC62230.1  | 27kDa calbindin                                                                                        | 249 | 5.00e-66 |
|  |  |                  | AAD08724.1  | calbindin 1                                                                                            | 249 | 5.00e-66 |
|  |  |                  | AAH06478.1  | AAH06478 calbindin 1, (28kD)                                                                           | 249 | 5.00e-66 |
|  |  |                  | AAH20864.1  | AAH20864 calbindin 1, (28kD)                                                                           | 249 | 5.00e-66 |

|             |                  |         |             |                                                                                              |  |     |          |
|-------------|------------------|---------|-------------|----------------------------------------------------------------------------------------------|--|-----|----------|
|             |                  |         | 1403296A    | calbindin 27kD                                                                               |  | 249 | 5.00e-66 |
|             |                  |         | 1709139A    | calbindin D28K                                                                               |  | 249 | 5.00e-66 |
|             |                  |         | NP_009019.1 | calbindin 2 isoform 22k; calbindin 2, (29kD, calretinin); calbindin D29K                     |  | 199 | 1.00e-50 |
|             |                  |         | NP_009018.1 | calbindin 2 isoform 20k; calbindin 2, (29kD, calretinin); calbindin D29K                     |  | 198 | 1.00e-50 |
| NM_013612   |                  |         | XP_002585.4 | similar to Natural resistance-associated macrophage protein 1 (NRAMP 1)                      |  | 905 | 0        |
| NP_038640.1 | U:(C-IR)<br>2.38 | Mm.2913 |             |                                                                                              |  |     |          |
|             |                  |         | P49279      | NRM1_HUMAN Natural resistance-associated macrophage protein 1 (NRAMP 1)                      |  | 905 | 0        |
|             |                  |         | I55679      | integral membrane protein                                                                    |  | 905 | 0        |
|             |                  |         | AAA57521.1  | integral membrane protein                                                                    |  | 905 | 0        |
|             |                  |         | BAA08908.1  | Nramp                                                                                        |  | 905 | 0        |
|             |                  |         | AAG15405.1  | natural resistance-associated macrophage protein 1                                           |  | 905 | 0        |
|             |                  |         | BAA08907.1  | Nramp                                                                                        |  | 904 | 0        |
|             |                  |         | JC4095      | natural resistance-associated macrophage protein NRAMP 1                                     |  | 889 | 0        |
|             |                  |         | NP_000569.1 | solute carrier family 11 (proton-coupled divalent metal ion transporters), member 1;         |  | 887 | 0        |
|             |                  |         |             | natural resistance-associated macrophage protein 1 (might include Leishmaniasis);            |  |     |          |
|             |                  |         |             | solute carrier family 11 (sodium/phosphate symporters), member 1                             |  |     |          |
|             |                  |         | CAA57541.1  | NRAMP                                                                                        |  | 887 | 0        |
|             |                  |         | BAA07370.1  | Nramp                                                                                        |  | 818 | 0        |
|             |                  |         | CAD38517.1  | divalent metal transporter                                                                   |  | 649 | 0        |
|             |                  |         | NP_000608.1 | solute carrier family 11 (proton-coupled divalent metal ion transporters), member 2;         |  | 649 | 0        |
|             |                  |         |             | natural resistance-associated macrophage protein 2                                           |  |     |          |
|             |                  |         | BAA24933.1  | NRAMP2                                                                                       |  | 649 | 0        |
|             |                  |         | AAC21460.1  | natural resistance-associated macrophage protein 2                                           |  | 649 | 0        |
|             |                  |         | AAC18078.1  | NRAMP2 iron transporter                                                                      |  | 649 | 0        |
|             |                  |         | AAH02592.1  | AAH02592 solute carrier family 11 (proton-coupled divalent metal ion transporters), member 2 |  | 649 | 0        |
|             |                  |         | P49281      | NRM2_HUMAN Natural resistance-associated macrophage protein 2 (NRAMP 2)                      |  | 648 | 0        |
|             |                  |         |             | (Divalent metal transporter 1) (DMT1)                                                        |  |     |          |

|             |          |          |             |                                                                                                                                                                                                                                |     |          |
|-------------|----------|----------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |          | AAC21459.1  | natural resistance-associated macrophage protein 2 non-IRE form                                                                                                                                                                | 648 | 0        |
|             |          |          | AAC21461.1  | natural resistance-associated macrophage protein 2                                                                                                                                                                             | 648 | 0        |
|             |          |          | BAB93467.1  | natural resistance-associated macrophage protein 2 non-IRE form                                                                                                                                                                | 648 | 0        |
|             |          |          | BAA34374.1  | natural resistance-associated macrophage protein 2                                                                                                                                                                             | 633 | 0        |
|             |          |          | I57022      | integral membrane protein                                                                                                                                                                                                      | 629 | e-180    |
|             |          |          | AAA79219.1  | integral membrane protein                                                                                                                                                                                                      | 629 | e-180    |
| NM_020503   | Mm.1038  | U:(C-IR) | NP_062545.1 | taste receptor T2R1; taste receptor, family B, member 7; taste receptor, type 2, member 1                                                                                                                                      | 260 | 2.00e-69 |
|             |          |          | AAF43902.1  | AF227129_1 candidate taste receptor T2R1                                                                                                                                                                                       | 260 | 2.00e-69 |
| NM_026091   | Mm.2771  | U:(C-IR) | BAB14854.1  | unnamed protein product                                                                                                                                                                                                        | 323 | 4.00e-88 |
| NP_080367.1 | 1        | 2.36     |             |                                                                                                                                                                                                                                |     |          |
|             |          |          | CAC17545.1  | dJ1009E24.3 (novel protein)                                                                                                                                                                                                    | 323 | 4.00e-88 |
|             |          |          | AAH12196.1  | AAH12196 Unknown (protein for MGC:4349)                                                                                                                                                                                        | 323 | 4.00e-88 |
|             |          |          | AAH24036.1  | chromosome 20 open reading frame 27                                                                                                                                                                                            | 323 | 4.00e-88 |
|             |          |          | NP_060344.1 | chromosome 20 open reading frame 27                                                                                                                                                                                            | 321 | 1.00e-87 |
|             |          |          | BAA91252.1  | unnamed protein product                                                                                                                                                                                                        | 321 | 1.00e-87 |
|             |          |          |             |                                                                                                                                                                                                                                |     |          |
| NM_008123   |          | U:(C-IR) |             |                                                                                                                                                                                                                                |     |          |
| NP_032149.1 | Mm.56907 | 2.35     | P48165      | CXA8_HUMAN Gap junction alpha-8 protein (Connexin 50) (Cx50) (Lens fiber protein MP70)                                                                                                                                         | 679 | 0        |
|             |          |          | AAF32309.1  | AF217524_1 gap junction protein alpha 8                                                                                                                                                                                        | 679 | 0        |
|             |          |          |             | gap junction protein, alpha 8, 50kDa (connexin 50); gap junction membrane channel protein alpha-8; connexin 50; Gap junction membrane channel protein alpha-8 (connexin 50); gap junction protein, alpha 8, 50kD (connexin 50) | 673 | 0        |
|             |          |          | NP_005258.1 |                                                                                                                                                                                                                                |     |          |
|             |          |          | I39176      | intrinsic membrane protein MP70                                                                                                                                                                                                | 673 | 0        |
|             |          |          | AAA77062.1  | gap junction membrane channel protein alpha-                                                                                                                                                                                   | 673 | 0        |
|             |          |          |             | gap junction protein, alpha 3, 46kDa (connexin 46); gap junction protein, alpha 3, 46kD (connexin 46)                                                                                                                          | 332 | 8.00e-91 |
|             |          |          | NP_068773.2 |                                                                                                                                                                                                                                |     |          |

|             |         |               |             |                                                                                                       |     |          |
|-------------|---------|---------------|-------------|-------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |               | CAC16957.1  | bA264J4.3 (novel connexin (gap junction protein))                                                     | 332 | 8.00e-91 |
|             |         |               | Q9Y6H8      | CXA3_HUMAN Gap junction alpha-3 protein (Connexin 46) (Cx46)                                          | 332 | 8.00e-91 |
|             |         |               | AAD42925.1  | gap-junction protein alpha 3                                                                          | 332 | 8.00e-91 |
|             |         |               | NP_005257.2 | gap junction protein, alpha 5, 40kDa (connexin 40); gap junction protein, alpha 5, 40kD (connexin 40) | 308 | 2.00e-83 |
|             |         |               | P36382      | CXA5_HUMAN Gap junction alpha-5 protein (Connexin 40) (Cx40)                                          | 308 | 2.00e-83 |
|             |         |               | AAA91833.1  | connexin 40                                                                                           | 308 | 2.00e-83 |
|             |         |               | AAD37801.1  | AF151979_1 connexin 40                                                                                | 308 | 2.00e-83 |
|             |         |               | AAA60457.2  | connexin40                                                                                            | 308 | 2.00e-83 |
|             |         |               | AAH13313.1  | AAH13313 gap junction protein, alpha 5, 40kD (connexin 40)8                                           | 308 | 2.00e-83 |
|             |         |               | I38429      | connexin40                                                                                            | 308 | 2.00e-83 |
|             |         |               | AAK55516.1  | AF271261_1 connexin 58                                                                                | 280 | 4.00e-75 |
|             |         |               | NP_110399.1 | connexin 59; gap junction alpha 10                                                                    | 280 | 4.00e-75 |
|             |         |               | P57773      | CXAA_HUMAN Gap junction alpha-10 protein (Connexin 59) (Cx59)                                         | 280 | 4.00e-75 |
|             |         |               | AAG09406.1  | AF179597_1 connexin 59                                                                                | 280 | 4.00e-75 |
|             |         |               | NP_115991.1 | connexin 62                                                                                           | 279 | 8.00e-75 |
|             |         |               | AAK51676.1  | AF296766_1 connexin 62                                                                                | 279 | 8.00e-75 |
|             |         |               | CAC93847.1  | connexin62                                                                                            | 279 | 8.00e-75 |
|             |         |               | AAD56533.1  | AF180815_1 truncated connexin 37 polymorph                                                            | 267 | 3.00e-71 |
|             |         |               | XP_036593.2 | similar to annexin A8                                                                                 | 596 | e-170    |
|             |         |               | AAH04376.1  | AAH04376 annexin A8                                                                                   | 596 | e-170    |
|             |         |               | NP_001621.1 | annexin VIII; Annexin VII                                                                             | 595 | e-169    |
|             |         |               | P13928      | ANX8_HUMAN Annexin A8 (Annexin VIII) (Vascular anticoagulant-beta) (VAC-beta)                         | 595 | e-169    |
|             |         |               | CAA34650.1  | vascular anticoagulant-beta (AA 1 - 327)                                                              | 595 | e-169    |
|             |         |               | LUHU8       | annexin VIII                                                                                          | 593 | e-169    |
| NM_013473   |         |               |             |                                                                                                       |     |          |
| NP_038501.2 | Mm.3267 | U:(C-IR) 2.35 |             |                                                                                                       |     |          |



|  |  |  |             |                                                                                                                                                                                                                                    |     |          |
|--|--|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  | AAB46383.1  | anexin VIII                                                                                                                                                                                                                        | 590 | e-168    |
|  |  |  | XP_054475.4 | similar to anexin A8                                                                                                                                                                                                               | 575 | e-165    |
|  |  |  | P09525      | ANX4_HUMAN Annexin A4 (Annexin IV) (Lipocortin IV) (Endonexin I) (Chromobindin 4) (Protein II) (P32.5) (Placental anticoagulant protein II) (PAP-II) (PP4-X) (35-beta calcimedlin) (Carbohydrate-binding protein P33/P41) (P33/41) | 337 | 4.00e-92 |
|  |  |  | NP_001144.1 | annexin IV; annexin IV (placental anticoagulant protein II); placental anticoagulant protein II                                                                                                                                    | 337 | 4.00e-92 |
|  |  |  | XP_031596.2 | similar to annexin IV; annexin IV (placental anticoagulant protein II); placental anticoagulant protein II                                                                                                                         | 337 | 4.00e-92 |
|  |  |  | A42077      | annexin IV                                                                                                                                                                                                                         | 337 | 4.00e-92 |
|  |  |  | AAA51740.1  | annexin IV (placental anticoagulant protein II)                                                                                                                                                                                    | 337 | 4.00e-92 |
|  |  |  | BAA11227.1  | annexin IV (carbohydrate-binding protein p33/41)                                                                                                                                                                                   | 337 | 4.00e-92 |
|  |  |  | AAH00182.1  | AAH00182 annexin A4                                                                                                                                                                                                                | 337 | 4.00e-92 |
|  |  |  | AAH11659.1  | AAH11659 Similar to annexin A4                                                                                                                                                                                                     | 337 | 4.00e-92 |
|  |  |  | AAC41689.1  | protein PP4-X                                                                                                                                                                                                                      | 337 | 4.00e-92 |
|  |  |  | 1ANW        | A Chain A, Annexin V                                                                                                                                                                                                               | 328 | 2.00e-89 |
|  |  |  | 1ANW        | B Chain B, Annexin V                                                                                                                                                                                                               | 328 | 2.00e-89 |
|  |  |  | 1ANX        | A Chain A, Annexin V                                                                                                                                                                                                               | 328 | 2.00e-89 |
|  |  |  | 1ANX        | B Chain B, Annexin V                                                                                                                                                                                                               | 328 | 2.00e-89 |
|  |  |  | 1ANX        | C Chain C, Annexin V                                                                                                                                                                                                               | 328 | 2.00e-89 |
|  |  |  | NP_001145.1 | annexin V; endonexin II; anchoring CII; lipocortin V; placental anticoagulant protein I                                                                                                                                            | 328 | 2.00e-89 |
|  |  |  | P08758      | ANX5_HUMAN Annexin V (Lipocortin V) (Endonexin II) (Calphobindin I) (CBP-I) (Placental anticoagulant protein I) (PAP-I) (PP4) (Thromboplastin inhibitor) (Vascular anticoagulant-alpha) (VAC-alpha) (Anchoring CII)                | 328 | 2.00e-89 |
|  |  |  | AQHUP       | annexin V [validated]                                                                                                                                                                                                              | 328 | 2.00e-89 |
|  |  |  | 1AVH        | A Chain A, Annexin V (Hexagonal Crystal Form)                                                                                                                                                                                      | 328 | 2.00e-89 |
|  |  |  | 1AVH        | B Chain B, Annexin V (Hexagonal Crystal Form)                                                                                                                                                                                      | 328 | 2.00e-89 |

|             |          |               |  |             |                                                                                                                                    |     |          |
|-------------|----------|---------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |               |  | 1HAK        | A Chain A, Crystal Structure Of Recombinant Human Placental Annexin V Complexed With K-201 As A Calcium Channel Activity Inhibitor | 328 | 2.00e-89 |
|             |          |               |  | 1HAK        | B Chain B, Crystal Structure Of Recombinant Human Placental Annexin V Complexed With K-201 As A Calcium Channel Activity Inhibitor | 328 | 2.00e-89 |
|             |          |               |  | 1AVR        | Annexin V (Rhombohedral Crystal Form)                                                                                              | 328 | 2.00e-89 |
|             |          |               |  | CAA30985.1  | VAC protein (AA 1-320)                                                                                                             | 328 | 2.00e-89 |
|             |          |               |  | AAA35570.1  | anticoagulant precursor (5' end put.); putative                                                                                    | 328 | 2.00e-89 |
|             |          |               |  | AAA52386.1  | endonexin II                                                                                                                       | 328 | 2.00e-89 |
|             |          |               |  | AAB59545.1  | anticoagulant protein 4                                                                                                            | 328 | 2.00e-89 |
|             |          |               |  | BAA00122.1  | blood coagulation inhibitor                                                                                                        | 328 | 2.00e-89 |
|             |          |               |  | AAA36166.1  | lipocortin-V                                                                                                                       | 328 | 2.00e-89 |
|             |          |               |  | AAB40047.1  | annexin V                                                                                                                          | 328 | 2.00e-89 |
|             |          |               |  | AAB60648.1  | annexin V                                                                                                                          | 328 | 2.00e-89 |
|             |          |               |  | AAH01429.1  | AAH01429 annexin A5                                                                                                                | 328 | 2.00e-89 |
|             |          |               |  | AAH04993.1  | AAH04993 annexin A5                                                                                                                | 328 | 2.00e-89 |
|             |          |               |  | AAH12804.1  | AAH12804 Similar to annexin A5                                                                                                     | 328 | 2.00e-89 |
|             |          |               |  | AAH12822.1  | AAH12822 Similar to annexin A5                                                                                                     | 328 | 2.00e-89 |
|             |          |               |  | 1512315A    | calphobindin                                                                                                                       | 328 | 2.00e-89 |
|             |          |               |  | 1313303A    | coagulation inhibitor                                                                                                              | 328 | 2.00e-89 |
| NM_008075   |          |               |  |             | gamma-aminobutyric acid (GABA) receptor, rho 1; gamma-aminobutyric acid (GABA) A receptor, rho-1                                   |     |          |
| NP_032101.1 | Mm.14116 | U:(C-IR) 2.33 |  | NP_002033.1 |                                                                                                                                    | 881 | 0        |
|             |          |               |  | P24046      | GAR1_HUMAN Gamma-aminobutyric-acid receptor rho-1 subunit precursor (GABA(A) receptor)                                             | 881 | 0        |
|             |          |               |  | A38627      | gamma-aminobutyric acid receptor A rho-1 chain precursor                                                                           | 881 | 0        |
|             |          |               |  | AAA52509.1  | gamma-aminobutyric acid receptor type A rho-1 subunit                                                                              | 881 | 0        |
|             |          |               |  | P28476      | GAR2_HUMAN Gamma-aminobutyric-acid receptor rho-2 subunit precursor (GABA(A) receptor)                                             | 654 | 0        |

|             |          |               |             |                                                                                         |     |          |
|-------------|----------|---------------|-------------|-----------------------------------------------------------------------------------------|-----|----------|
|             |          |               | CAC07339.1  | dJ131H7.1 (gamma-aminobutyric acid (GABA) receptor rho 2)                               | 654 | 0        |
|             |          |               | NP_002034.1 | gamma-aminobutyric acid (GABA) receptor, rho 2 precursor                                | 652 | 0        |
|             |          |               | A38079      | gamma-aminobutyric acid receptor rho-2 chain precursor                                  | 652 | 0        |
|             |          |               | AAA52510.1  | gamma-amino butyric acid                                                                | 652 | 0        |
|             |          |               | XP_116036.2 | similar to Gamma-aminobutyric-acid receptor rho-3 subunit precursor (GABA(A) receptor)  | 459 | e-129    |
|             |          |               | NP_068712.1 | gamma-aminobutyric acid (GABA) A receptor, beta 3, isoform 2 precursor                  | 315 | 2.00e-85 |
|             |          |               | NP_000805.1 | gamma-aminobutyric acid (GABA) A receptor, beta 3, isoform 1 precursor                  | 315 | 2.00e-85 |
|             |          |               | P28472      | GAB3_HUMAN Gamma-aminobutyric-acid receptor beta-3 subunit precursor (GABA(A) receptor) | 315 | 2.00e-85 |
|             |          |               | A5275       | gamma-aminobutyric acid A receptor beta 3 chain splice form 1                           | 315 | 2.00e-85 |
|             |          |               | AAA52511.1  | GABA-alpha receptor beta-3 subunit                                                      | 315 | 2.00e-85 |
|             |          |               | AAH10641.1  | gamma-aminobutyric acid (GABA) A receptor, beta 3                                       | 312 | 1.00e-84 |
|             |          |               | NP_000806.1 | gamma-aminobutyric acid (GABA) A receptor, delta                                        | 305 | 2.00e-82 |
|             |          |               | O14764      | GAD_HUMAN Gamma-aminobutyric-acid receptor delta subunit precursor (GABA(A) receptor)   | 305 | 2.00e-82 |
|             |          |               | AAB70007.1  | GABA-A receptor delta subunit                                                           | 305 | 2.00e-82 |
|             |          |               | AAH33801.1  | gamma-aminobutyric acid (GABA) A receptor, delta                                        | 302 | 2.00e-81 |
|             |          |               | NP_000804.1 | gamma-aminobutyric acid (GABA) A receptor, beta 2, isoform 2                            | 302 | 2.00e-81 |
|             |          |               | P47870      | GAB2_HUMAN Gamma-aminobutyric-acid receptor beta-2 subunit precursor (GABA(A) receptor) | 302 | 2.00e-81 |
|             |          |               | AAB29370.1  | gamma-aminobutyric acid A receptor beta 2 subunit; (GABA)A receptor beta 2 subunit      | 302 | 2.00e-81 |
|             |          |               | AAB33983.1  | GABAA receptor beta 2 subunit                                                           | 302 | 2.00e-81 |
| NM_008009   |          |               |             |                                                                                         |     |          |
| NP_032035.1 | Mm.46053 | U:(C-IR) 2.32 | NP_005121.1 | heparin-binding growth factor binding protein                                           | 268 | 2.00e-71 |
|             |          |               | A41178      | heparin-binding growth factor-binding protein precursor                                 | 268 | 2.00e-71 |

|             |         |                  |             |                                                                                                                                                                                                                                                               |     |          |
|-------------|---------|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |                  | AAA58636.1  | heparin binding protein                                                                                                                                                                                                                                       | 268 | 2.00e-71 |
|             |         |                  | AAD39216.1  | AF149412_1 HBP17 heparin-binding and FGF-binding protein                                                                                                                                                                                                      | 268 | 2.00e-71 |
|             |         |                  | AAH03628.1  | heparin-binding growth factor binding protein                                                                                                                                                                                                                 | 268 | 2.00e-71 |
|             |         |                  | AAH08910.1  | heparin-binding growth factor binding protein                                                                                                                                                                                                                 | 268 | 2.00e-71 |
| NM_008352   |         | U:(C-IR)<br>2.29 |             | interleukin 12B precursor; natural killer cell stimulatory factor-2; interleukin 12B; cytotoxic lymphocyte maturation factor 2, p40; interleukin-12 beta chain; interleukin 12, p40; natural killer cell stimulatory factor, 40 kD subunit; IL23, subunit p40 |     |          |
| NP_032378.1 |         | U:(C-D)<br>2.24  | NP_002178.2 |                                                                                                                                                                                                                                                               | 431 | e-120    |
|             |         |                  |             | I12B_HUMAN Interleukin-12 beta chain precursor (IL-12B) (Cytotoxic lymphocyte maturation factor 40 kDa subunit) (CLMF p40) (NK cell stimulatory factor chain 2) (NKSF2)                                                                                       |     |          |
|             |         |                  | P29460      |                                                                                                                                                                                                                                                               | 431 | e-120    |
|             |         |                  | A38957      | interleukin 12B precursor                                                                                                                                                                                                                                     | 431 | e-120    |
|             |         |                  | AAA35695.1  | cytotoxic lymphocyte maturation factor 40 kDa subunit                                                                                                                                                                                                         | 431 | e-120    |
|             |         |                  | AAD56386.1  | AF180563_1 interleukin 12, P40                                                                                                                                                                                                                                | 431 | e-120    |
|             |         |                  | AAG32620.1  | interleukin 12 p40 subunit                                                                                                                                                                                                                                    | 431 | e-120    |
|             |         |                  |             | AF512686_1 interleukin 12B (natural killer cell stimulatory factor 2, cytotoxic lymphocyte maturation factor 2, p40)                                                                                                                                          | 431 | e-120    |
|             |         |                  | AAM34792.1  |                                                                                                                                                                                                                                                               | 429 | e-120    |
|             |         |                  | AAA59938.1  | natural killer cell stimulatory factor                                                                                                                                                                                                                        | 400 | e-111    |
|             |         |                  | 1F42        | A Chain A, The P40 Domain Of Human Interleukin-12                                                                                                                                                                                                             | 400 | e-111    |
|             |         |                  | 1F45        | A Chain A, Human Interleukin-12                                                                                                                                                                                                                               | 234 | 5.00e-61 |
| NM_019980   | Mm.2111 | U:(C-IR)<br>2.28 | BAB32547.1  | small integral membrane protein of lysosome/late endosome                                                                                                                                                                                                     |     |          |
| NP_064364.1 | 9       | U:(C-D)<br>2.11  |             |                                                                                                                                                                                                                                                               |     |          |
|             |         |                  | NP_004853.1 | LPS-induced TNF-alpha factor                                                                                                                                                                                                                                  | 178 | 3.00e-56 |





|             |         |                  |                                                                                                                                                        |              |
|-------------|---------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| NM_008166   |         |                  |                                                                                                                                                        |              |
| NP_032192.1 | Mm.7983 | U:(C-IR)<br>2.26 | BAA86534.1 KIAA1220 protein                                                                                                                            | 1495 0       |
|             |         |                  | XP_043613.7 similar to glutamate receptor delta-1 subunit                                                                                              | 1379 0       |
|             |         |                  | AAH39263.1 Similar to glutamate receptor, ionotropic, delta 1                                                                                          | 1202 0       |
|             |         |                  | NP_001501.1 glutamate receptor, ionotropic, delta 2; GluR-delta-2                                                                                      | 1141 0       |
|             |         |                  | O43424 GRD2_HUMAN Glutamate receptor delta-2 subunit precursor                                                                                         | 1141 0       |
|             |         |                  | AAC39579.1 glutamate receptor delta-2 subunit                                                                                                          | 1141 0       |
|             |         |                  | NP_000821.1 glutamate receptor, ionotropic, kainate 1; human glutamate receptor (GLUR5)                                                                | 362 2.00e-99 |
|             |         |                  | P39086 GLK1_HUMAN Glutamate receptor, ionotropic kainate 1 precursor (Glutamate receptor 5) (GluR-5) (GluR5) (Excitatory amino acid receptor 3) (EAA3) | 362 2.00e-99 |
|             |         |                  | I58178 glutamate receptor                                                                                                                              | 362 2.00e-99 |
|             |         |                  | AAA52568.1 glutamate receptor                                                                                                                          | 362 2.00e-99 |
|             |         |                  | CAC80546.1 glutamate receptor subunit GluR5                                                                                                            | 359 1.00e-98 |
|             |         |                  | AAA95961.1 EAA3                                                                                                                                        | 357 8.00e-98 |
|             |         |                  | CAC80548.1 glutamate/kainate receptor subtype GluR7                                                                                                    | 346 1.00e-94 |
|             |         |                  | NP_000822.1 glutamate receptor, ionotropic, kainate 3                                                                                                  | 344 5.00e-94 |
|             |         |                  | AAB60407.1 EAA5                                                                                                                                        | 344 5.00e-94 |
| NM_011427   |         | U:(C-IR)<br>2.26 | AAD17332.1 zinc finger protein                                                                                                                         | 442 e-124    |
| NP_035557.1 | Mm.2093 |                  |                                                                                                                                                        |              |
|             |         |                  | NP_005976.2 snail 1 homolog; snail 1 zinc finger protein                                                                                               | 442 e-124    |
|             |         |                  | O95863 SNAI_HUMAN Zinc finger protein SNAI1 (Snail protein homolog) (Sna protein)                                                                      | 442 e-124    |
|             |         |                  | CAB52414.1 SNAI1 protein                                                                                                                               | 442 e-124    |
|             |         |                  | AAD52986.1 AF155233_1 snail zinc finger protein                                                                                                        | 442 e-124    |
|             |         |                  | CAC07340.1 dJ10H13.1 (snail 1 (drosophila homolog), zinc finger protein)                                                                               | 442 e-124    |
|             |         |                  | AAH12910.1 AAH12910 Unknown (protein for MGC:21748)                                                                                                    | 442 e-124    |
|             |         |                  | XP_065615.1 similar to snail 1 (drosophila homolog), zinc finger protein                                                                               | 355 1.00e-97 |
|             |         |                  | AAF32527.1 AF131208_1 snail protein                                                                                                                    | 250 3.00e-66 |

|             |         |          |  |             |                                                                                                                                                                                                                                                                                                             |     |          |
|-------------|---------|----------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |          |  | NP_003059.1 | snail 2; neural crest transcription factor SLUG; slug (chicken homolog), zinc finger protein                                                                                                                                                                                                                | 249 | 6.00e-66 |
|             |         |          |  | O43623      | SLUG_HUMAN Zinc finger protein SLUG (Neural crest transcription factor Slug) (Snail homolog 2)                                                                                                                                                                                                              | 249 | 6.00e-66 |
|             |         |          |  | AAC34288.1  | zinc finger protein slug                                                                                                                                                                                                                                                                                    | 249 | 6.00e-66 |
|             |         |          |  | AAD55240.1  | AF084243 1 zinc finger protein SLUG                                                                                                                                                                                                                                                                         | 249 | 6.00e-66 |
|             |         |          |  | AAH14890.1  | AAH14890 slug (chicken homolog), zinc finger protein                                                                                                                                                                                                                                                        | 249 | 6.00e-66 |
|             |         |          |  | AAH15895.1  | AAH15895 slug (chicken homolog), zinc finger protein                                                                                                                                                                                                                                                        | 249 | 6.00e-66 |
| NM_021546   | Mm.1437 | U:(C-IR) |  | AAL01118.1  | AF409141_1 NIP1                                                                                                                                                                                                                                                                                             | 477 | e-134    |
| NP_067521.1 | 48      | 2.26     |  | NP_112508.1 | amyloid beta (A4) precursor protein-binding, family A, member 2 binding protein, isoform 1; synaptotagmin interacting protein STIP3; X11L-binding protein 51; amyloid beta (A4) precursor protein-binding, family A, member 2; synaptotagmin interacting protein 2; neuronal calcium-binding protein NECAB3 | 475 | e-134    |
|             |         |          |  | AAG28415.1  | AF193759_1 neuronal calcium binding protein NECAB3                                                                                                                                                                                                                                                          | 475 | e-134    |
|             |         |          |  | CAD37360.1  | dJ63M2.4.1 (amyloid beta (A4) precursor protein-binding family A, member 2 protein, variant 1)                                                                                                                                                                                                              | 397 | e-110    |
|             |         |          |  | NP_112509.1 | amyloid beta (A4) precursor protein-binding, family A, member 2 binding protein, isoform 2; synaptotagmin interacting protein STIP3; X11L-binding protein 51; amyloid beta (A4) precursor protein-binding, family A, member 2; synaptotagmin interacting protein 2; neuronal calcium-binding protein NECAB3 | 358 | 2.00e-98 |
|             |         |          |  | BAB16413.1  | X11L-binding protein 51                                                                                                                                                                                                                                                                                     | 358 | 2.00e-98 |
|             |         |          |  | NP_071746.1 | synaptotagmin interacting protein 1                                                                                                                                                                                                                                                                         | 254 | 3.00e-67 |
|             |         |          |  | BAC04568.1  | unnamed protein product                                                                                                                                                                                                                                                                                     | 254 | 3.00e-67 |
|             |         |          |  | AAG28412.1  | AF193756_1 neuronal calcium binding protein NECAB1                                                                                                                                                                                                                                                          | 196 | 7.00e-50 |
| NM_025746   | Mm.4614 | U:(C-IR) |  | 2208307A    | PNG gene                                                                                                                                                                                                                                                                                                    | 206 | 9.00e-53 |
| NP_080022.1 | 2       | 2.24     |  |             |                                                                                                                                                                                                                                                                                                             |     |          |
|             |         |          |  |             |                                                                                                                                                                                                                                                                                                             |     |          |



|                          |              |                                      |  |             |                                                                                                                                                                                                                                                                                                                            |  |     |          |  |
|--------------------------|--------------|--------------------------------------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|--|
|                          |              |                                      |  |             |                                                                                                                                                                                                                                                                                                                            |  |     |          |  |
| AK010751                 |              |                                      |  |             |                                                                                                                                                                                                                                                                                                                            |  |     |          |  |
| AAN60072.1               | Mm.29522     | U:(C-IR)<br>2.23                     |  | AAL23683.1  | MARK4 serine/threonine protein kinase                                                                                                                                                                                                                                                                                      |  | 183 | 9.00e-51 |  |
|                          |              |                                      |  | BAC11510.1  | unnamed protein product                                                                                                                                                                                                                                                                                                    |  | 183 | 9.00e-51 |  |
|                          |              |                                      |  | AAM55491.1  | MAP/microtubule affinity-regulating kinase-like 1                                                                                                                                                                                                                                                                          |  | 183 | 9.00e-51 |  |
|                          |              |                                      |  | BAC03375.1  | microtubule affinity-regulating kinase-like1                                                                                                                                                                                                                                                                               |  | 183 | 9.00e-51 |  |
|                          |              |                                      |  | BAB55238.1  | unnamed protein product                                                                                                                                                                                                                                                                                                    |  | 183 | 9.00e-51 |  |
| NM_028189<br>NP_082465.1 | Mm.2885<br>6 | U:(C-IR)<br>2.22<br>U:(C-IR)<br>2.41 |  | BAB21531.1  | beta-1,3-N-acetylglucosaminyltransferase bGnT-3                                                                                                                                                                                                                                                                            |  | 508 | e-144    |  |
|                          |              |                                      |  | NP_055071.1 | beta-1,3-N-acetylglucosaminyltransferase bGnT-3; type II membrane protein; transmembrane protein 3; core 1 extending beta-1,3-N-acetylglucosaminyltransferase; beta-1,3-galactosyltransferase; beta-1,3-galactase 8; beta3gal-T8; UDP-galactose:beta-N-acetylglucosamine beta-1,3-galactosyltransferase 8; beta-3-GX-T8    |  | 506 | e-143    |  |
|                          |              |                                      |  | Q9Y2A9      | B3G8_HUMAN Beta-1,3-galactosyltransferase 8 (Beta-1,3-GalTase 8) (Beta3Gal-T8) (b3Gal-T8) (UDP-galactose:beta-N-acetylglucosamine beta-1,3-galactosyltransferase 8) (UDP-Gal:beta-GlcNAc beta-1,3-galactosyltransferase 8) (Beta-3-Gx-T8) (Core 1 extending beta-1,3-N-acetylglucosaminyltransferase) (Core1-beta3GlcNAcT) |  | 506 | e-143    |  |
|                          |              |                                      |  | BAA76497.1  | type II membrane protein                                                                                                                                                                                                                                                                                                   |  | 506 | e-143    |  |
|                          |              |                                      |  | AAK00849.1  | AF293973_1 core 1 extending beta-1,3-N-acetylglucosaminyltransferase                                                                                                                                                                                                                                                       |  | 506 | e-143    |  |
|                          |              |                                      |  | CAC45044.1  | beta-1,3-galactosyltransferase                                                                                                                                                                                                                                                                                             |  | 506 | e-143    |  |
|                          |              |                                      |  | CAC82374.1  | beta 1,6-GlcNAc-transferase                                                                                                                                                                                                                                                                                                |  | 458 | e-128    |  |
|                          |              |                                      |  | NP_619651.1 | beta-1,3-N-acetylglucosaminyltransferase protein                                                                                                                                                                                                                                                                           |  | 332 | 1.00e-90 |  |
|                          |              |                                      |  | BAB88882.1  | beta-1,3-N-acetylglucosaminyltransferase 6                                                                                                                                                                                                                                                                                 |  | 332 | 1.00e-90 |  |
|                          |              |                                      |  | AAH25357.1  | Unknown (protein for IMAGE:4907098)                                                                                                                                                                                                                                                                                        |  | 298 | 3.00e-80 |  |
|                          |              |                                      |  | NP_660279.1 | UDP-GlcNAc:betaGal beta-1,3-N-acetylglucosaminyltransferase 7; hypothetical gene supported by AK000770                                                                                                                                                                                                                     |  | 266 | 1.00e-70 |  |

|             |          |                  |  |             |                                                                                                                      |      |          |
|-------------|----------|------------------|--|-------------|----------------------------------------------------------------------------------------------------------------------|------|----------|
|             |          |                  |  | AAM61770.1  | AF502430_1 beta 1,3-N-acetylglucosaminyltransferase 7                                                                | 266  | 1.00e-70 |
|             |          |                  |  | CAC45045.1  | beta-1,3-galactosyltransferase                                                                                       | 254  | 4.00e-67 |
|             |          |                  |  | BAC04622.1  | unnamed protein product                                                                                              | 253  | 9.00e-67 |
|             |          |                  |  | CAC82375.1  | beta 1,3 galactosyltransferase                                                                                       | 253  | 9.00e-67 |
|             |          |                  |  | AAL37219.1  | AF321825_1 beta-1,3-galactosyltransferase-related protein                                                            | 253  | 9.00e-67 |
| NM_008522   |          |                  |  |             |                                                                                                                      |      |          |
| NP_032548.1 | Mm.7612  | U:(C-IR)<br>2.22 |  | AAA59479.1  | neutrophil lactoferrin                                                                                               | 1038 | 0        |
|             |          |                  |  | P02788      | TRFL_HUMAN Lactotransferrin precursor (Lactoferrin) [Contains: Lactoferroxin A;<br>Lactoferroxin B; Lactoferroxin C] | 1038 | 0        |
|             |          |                  |  | TFHUL       | lactotransferrin precursor                                                                                           | 1038 | 0        |
|             |          |                  |  | AAB60324.1  | lactoferrin                                                                                                          | 1038 | 0        |
|             |          |                  |  | AAH15822.1  | lactotransferrin                                                                                                     | 1036 | 0        |
|             |          |                  |  | AAH22347.1  | lactotransferrin                                                                                                     | 1035 | 0        |
|             |          |                  |  | CAA37116.1  | precursor lactoferrin (709 AA)                                                                                       | 1035 | 0        |
|             |          |                  |  | AAA36159.1  | lactoferrin                                                                                                          | 1035 | 0        |
|             |          |                  |  | AAN11304.1  | lactoferrin                                                                                                          | 1035 | 0        |
|             |          |                  |  | AAA59511.1  | lactoferrin                                                                                                          | 1035 | 0        |
|             |          |                  |  | AAG48753.1  | lactoferrin precursor                                                                                                | 1034 | 0        |
|             |          |                  |  | AAN63998.1  | lactotransferrin precursor                                                                                           | 1034 | 0        |
|             |          |                  |  | AAH15823.1  | lactotransferrin                                                                                                     | 1033 | 0        |
|             |          |                  |  | NP_002334.1 | lactotransferrin                                                                                                     | 1032 | 0        |
|             |          |                  |  | CAA37914.1  | precursor (AA -19 to 692)                                                                                            | 1032 | 0        |
| NM_009637   |          |                  |  |             |                                                                                                                      |      |          |
| NP_033767.1 | Mm.86453 | U:(C-IR)<br>2.22 |  | XP_058567.1 | similar to AE binding protein 2; AE-binding protein 2                                                                | 562  | e-160    |
|             |          |                  |  | NP_694939.1 | hypothetical protein MGC17922                                                                                        | 562  | e-160    |
|             |          |                  |  | AAH15624.1  | AAH15624 Similar to AE-binding protein 2                                                                             | 562  | e-160    |

|             |         |          |  |             |                                                                                                                                                                                |  |     |          |
|-------------|---------|----------|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |          |  | AAH22220.1  | Unknown (protein for MGC:17922)                                                                                                                                                |  | 562 | e-160    |
| NM_010198   | Mm.5723 | U:(C-IR) |  | NP_004103.1 | fibroblast growth factor 11; fibroblast growth factor homologous factor 3                                                                                                      |  | 444 | e-125    |
| NP_034328.1 | 8       | 2.22     |  | Q92914      | FGFB_HUMAN Fibroblast growth factor-11 (FGF-11) (Fibroblast growth factor homologous factor 3) (FHF-3)                                                                         |  | 444 | e-125    |
|             |         |          |  | AAB18915.1  | fibroblast growth factor homologous factor 3                                                                                                                                   |  | 444 | e-125    |
|             |         |          |  | AAL15439.1  | fibroblast growth factor 11                                                                                                                                                    |  | 444 | e-125    |
|             |         |          |  | AAM11871.1  | fibroblast growth factor 11                                                                                                                                                    |  | 444 | e-125    |
|             |         |          |  | AAH32502.1  | fibroblast growth factor 11                                                                                                                                                    |  | 444 | e-125    |
|             |         |          |  | NP_004106.1 | fibroblast growth factor 14; fibroblast growth factor homologous factor 4                                                                                                      |  | 273 | 1.00e-73 |
|             |         |          |  | Q92915      | FGFE_HUMAN Fibroblast growth factor-14 (FGF-14) (Fibroblast growth factor homologous factor 4) (FHF-4)                                                                         |  | 273 | 1.00e-73 |
|             |         |          |  | AAB18916.1  | fibroblast growth factor homologous factor 4                                                                                                                                   |  | 273 | 1.00e-73 |
|             |         |          |  | AAN16025.1  | AE014303 1 FHF4                                                                                                                                                                |  | 273 | 1.00e-73 |
|             |         |          |  | NP_066360.1 | fibroblast growth factor 12 isoform 1; fibroblast growth factor homologous factor 1; myocyte-activating factor; fibroblast growth factor 12B; fibroblast growth factor FGF-12b |  | 273 | 2.00e-73 |
|             |         |          |  | Q92912      | FGFC_HUMAN Fibroblast growth factor-12 (FGF-12) (Fibroblast growth factor homologous factor 1) (FHF-1) (Myocyte-activating factor)                                             |  | 273 | 2.00e-73 |
|             |         |          |  | AAB18913.1  | fibroblast growth factor homologous factor 1                                                                                                                                   |  | 273 | 2.00e-73 |
|             |         |          |  | CAA94239.1  | fibroblast growth factor 11                                                                                                                                                    |  | 261 | 5.00e-70 |
|             |         |          |  | NP_004105.1 | fibroblast growth factor 13, isoform 1A; fibroblast growth factor homologous factor 2                                                                                          |  | 246 | 2.00e-65 |
|             |         |          |  | Q92913      | FGFD_HUMAN Fibroblast growth factor-13 (FGF-13) (Fibroblast growth factor homologous factor 2) (FHF-2)                                                                         |  | 246 | 2.00e-65 |
|             |         |          |  | AAB18914.1  | fibroblast growth factor homologous factor 2                                                                                                                                   |  | 246 | 2.00e-65 |
|             |         |          |  | AAD16400.1  | fibroblast growth factor 13 isoform 1A                                                                                                                                         |  | 246 | 2.00e-65 |
|             |         |          |  | AAH12347.1  | AAH12347 Unknown (protein for MGC:20109)                                                                                                                                       |  | 246 | 2.00e-65 |
|             |         |          |  | AAH34340.1  | fibroblast growth factor 13                                                                                                                                                    |  | 246 | 2.00e-65 |

|             |                  |          |             |                                                                                                                                                                                |     |          |
|-------------|------------------|----------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |                  |          | NP_004104.3 | fibroblast growth factor 12 isoform 2; fibroblast growth factor homologous factor 1; myocyte-activating factor; fibroblast growth factor 12B; fibroblast growth factor FGF-12b | 223 | 2.00e-58 |
|             |                  |          | JG0184      | fibroblast growth factor - human                                                                                                                                               | 221 | 7.00e-58 |
|             |                  |          | AAB18786.3  | fibroblast growth factor                                                                                                                                                       | 221 | 7.00e-58 |
|             |                  |          | AAH22524.1  | Unknown (protein for MGC:26659)                                                                                                                                                | 219 | 2.00e-57 |
|             |                  |          | NP_378668.1 | fibroblast growth factor 13 isoform 1B; fibroblast growth factor homologous factor 2                                                                                           | 213 | 1.00e-55 |
|             |                  |          | AAD16401.1  | fibroblast growth factor 13 isoform 1B                                                                                                                                         | 213 | 1.00e-55 |
| NM_007995   | U:(C-IR)<br>2.21 |          |             |                                                                                                                                                                                |     |          |
| NP_032021.1 | U:(C-D)<br>2.45  | Mm.10510 | NP_001994.2 | ficolin 1 precursor; ficolin (collagen/fibrinogen domain-containing) 1                                                                                                         | 386 | e-107    |
|             |                  |          | O00602      | FCN1_HUMAN Ficolin 1 precursor (Collagen/fibrinogen domain-containing protein 1) (Ficolin-A) (Ficolin A) (M-Ficolin)                                                           | 386 | e-107    |
|             |                  |          | AAH20635.1  | ficolin (collagen/fibrinogen domain-containing) 1                                                                                                                              | 386 | e-107    |
|             |                  |          | BAA12120.1  | ficolin                                                                                                                                                                        | 386 | e-107    |
|             |                  |          | S61517      | ficolin-1 precursor                                                                                                                                                            | 382 | e-106    |
|             |                  |          | AAB50706.1  | ficolin                                                                                                                                                                        | 382 | e-106    |
|             |                  |          | NP_004099.1 | ficolin 2 isoform a precursor; ficolin (collagen/fibrinogen domain-containing lectin) 2 (hucolin); ficolin (collagen/fibrinogen domain-containing lectin) 2; hucolin           | 379 | e-105    |
|             |                  |          | Q15485      | FCN2_HUMAN Ficolin 2 precursor (Collagen/fibrinogen domain-containing protein 2) (Ficolin-B) (Ficolin B) (Serum lectin p35) (EBP-37) (Hucolin) (L-Ficolin)                     | 379 | e-105    |
|             |                  |          | BAA08352.1  | serum lectin P35                                                                                                                                                               | 379 | e-105    |
|             |                  |          | BAA09636.1  | lectin P35                                                                                                                                                                     | 379 | e-105    |
|             |                  |          | NP_056652.1 | ficolin 2 isoform b precursor; ficolin (collagen/fibrinogen domain-containing lectin) 2 (hucolin); ficolin (collagen/fibrinogen domain-containing lectin) 2; hucolin           | 352 | 6.00e-97 |
|             |                  |          | NP_003656.1 | ficolin 3 precursor; ficolin (collagen/fibrinogen domain-containing) 3 (Hakata antigen)                                                                                        | 289 | 5.00e-78 |



|             |         |                  |             |                                                                                                                                                    |     |          |
|-------------|---------|------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |                  | NP_004760.1 | testis amiloride-sensitive cation channel 3, isoform a; testis sodium channel 1; proton-gated cation channel subunit; modulatory subunit of ASIC2a | 211 | 3.00e-54 |
|             |         |                  | AAC64188.1  | proton-gated cation channel ASIC3                                                                                                                  | 211 | 3.00e-54 |
|             |         |                  | NP_064718.1 | testis amiloride-sensitive cation channel 3, isoform c; testis sodium channel 1; proton-gated cation channel subunit; modulatory subunit of ASIC2a | 211 | 3.00e-54 |
|             |         |                  | AAF19817.1  | AF195024_1 acid sensing ion channel 3 splice variant b                                                                                             | 211 | 3.00e-54 |
|             |         |                  | NP_001085.2 | neuronal amiloride-sensitive cation channel 1; degenerin                                                                                           | 206 | 1.00e-52 |
|             |         |                  | Q16515      | BNA1_HUMAN Amiloride-sensitive brain sodium channel BNAC1 (Amiloride-sensitive cation channel neuronal 1) (BNC1) (Degenerin channel MDEG)          | 206 | 1.00e-52 |
|             |         |                  | AAC50498.1  | degenerin channel MDEG                                                                                                                             | 206 | 1.00e-52 |
|             |         |                  | AAB49182.1  | sodium channel 1                                                                                                                                   | 206 | 1.00e-52 |
|             |         |                  | AAC50432.1  | sodium channel 1                                                                                                                                   | 206 | 1.00e-52 |
|             |         |                  | 2211325A    | Na channel                                                                                                                                         | 206 | 1.00e-52 |
|             |         |                  | JE0091      | testis sodium channel 1                                                                                                                            | 203 | 5.00e-52 |
|             |         |                  | BAA25897.1  | sodium channel                                                                                                                                     | 203 | 5.00e-52 |
| NM_019815   | Mm.3509 | U:(C-IR)<br>2.17 | NP_057453.1 | claudin 18                                                                                                                                         | 424 | e-118    |
| NP_062789.1 | 0       | U:(C-D)<br>2.12  |             |                                                                                                                                                    |     |          |
|             |         |                  | P56856      | CLDI_HUMAN Claudin-18                                                                                                                              | 424 | e-118    |
|             |         |                  | AAF26448.1  | AF221069_1 Claudin-18                                                                                                                              | 424 | e-118    |
|             |         |                  | AAL15637.1  | AF349452_1 claudin-18A2.1                                                                                                                          | 399 | e-110    |
|             |         | U:(C-IR)<br>2.17 | NP_443192.1 | retinoid binding protein 7; putative cellular retinol-binding protein CRBP IV                                                                      | 259 | 2.00e-69 |
| NM_022020   | Mm.4602 | U:(C-D)<br>2.04  |             |                                                                                                                                                    |     |          |
| NP_071303.1 | 3       |                  | Q96R05      | RET7_HUMAN Retinol-binding protein IV, cellular (CRBP-IV) (Retinoid binding protein 7)                                                             | 259 | 2.00e-69 |
|             |         |                  | AAK85409.1  | retinoid binding protein 7                                                                                                                         | 259 | 2.00e-69 |

|             |         |                  |             |                                                                                   |     |          |
|-------------|---------|------------------|-------------|-----------------------------------------------------------------------------------|-----|----------|
|             |         |                  | AAN61071.1  | putative cellular retinol-binding protein CRBP IV                                 | 259 | 2.00e-69 |
|             |         |                  | AAH33883.1  | Similar to retinoid binding protein 7                                             | 212 | 3.00e-55 |
| NM_007702   |         |                  |             |                                                                                   |     |          |
| NP_031728.1 | Mm.449  | U:(C-IR)<br>2.16 | NP_001270.1 | cell death-inducing DFFA-like effector a                                          | 340 | 3.00e-93 |
|             |         |                  | O60543      | CIDA_HUMAN Cell death activator CIDE-A (Cell death-inducing DFFA-like effector A) | 340 | 3.00e-93 |
|             |         |                  | AAC34987.1  | cell death activator CIDE-A                                                       | 340 | 3.00e-93 |
|             |         |                  | AAH31896.1  | Similar to cell death-inducing DFFA-like effector a                               | 319 | 5.00e-87 |
| NM_025639   | Mm.2359 | U:(C-IR)<br>2.16 | NP_076958.1 | hypothetical protein MGC861                                                       | 293 | 2.00e-79 |
| NP_079915.1 | 6       |                  |             |                                                                                   |     |          |
|             |         |                  | CAB77147.1  | hypothetical protein                                                              | 293 | 2.00e-79 |
|             |         |                  | AAH00705.1  | AAH00705 Unknown (protein for MGC.861)                                            | 293 | 2.00e-79 |
|             |         |                  | AAH07495.1  | AAH07495 hypothetical protein MGC861                                              | 293 | 2.00e-79 |
| NM_025834   | Mm.8079 | U:(C-IR)<br>2.16 | NP_003882.1 | protein Z, vitamin K-dependent plasma glycoprotein                                | 560 | e-159    |
| NP_080110.1 | 8       |                  |             |                                                                                   |     |          |
|             |         |                  | P22891      | PRTZ_HUMAN Vitamin K-dependent protein Z precursor                                | 560 | e-159    |
|             |         |                  | AAA36500.1  | protein Z                                                                         | 560 | e-159    |
|             |         |                  | BAA85763.1  | protein Z                                                                         | 560 | e-159    |
|             |         |                  | AAL27631.1  | AF440358_1 protein Z, vitamin K-dependent plasma glycoprotein                     | 560 | e-159    |
|             |         |                  | KXHUZ       | plasma protein Z precursor                                                        | 550 | e-156    |
|             |         |                  | AAA36501.1  | protein Z                                                                         | 550 | e-156    |
|             |         |                  | BAA85764.1  | protein Z spliced variant                                                         | 550 | e-156    |
|             |         |                  | AAA36499.1  | protein Z                                                                         | 454 | e-127    |
|             |         |                  | AAA51984.1  | coagulation factor X precursor                                                    | 214 | 7.00e-55 |
|             |         |                  | 1205236A    | coagulation factor X                                                              | 214 | 7.00e-55 |
|             |         |                  | AAA52490.1  | factor X prepeptide                                                               | 213 | 1.00e-54 |
|             |         |                  | NP_000495.1 | coagulation factor X precursor; Prothrombinase                                    | 213 | 1.00e-54 |

|                      |         |                  |             |                                                                                                                                                                                                |      |          |
|----------------------|---------|------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|                      |         |                  | P00742      | FA10_HUMAN Coagulation factor X precursor (Stuart factor)                                                                                                                                      | 213  | 1.00e-54 |
|                      |         |                  | EXHU        | coagulation factor Xa (EC 3.4.21.6) precursor                                                                                                                                                  | 213  | 1.00e-54 |
|                      |         |                  | AAA52421.1  | coagulation factor X                                                                                                                                                                           | 213  | 1.00e-54 |
|                      |         |                  | AAA52764.1  | coagulation factor X                                                                                                                                                                           | 213  | 1.00e-54 |
|                      |         |                  | AAM19347.1  | AF503510 1 coagulation factor X                                                                                                                                                                | 213  | 1.00e-54 |
|                      |         |                  | CAA21954.1  | F9 (coagulation factor IX (plasma thromboplastic component, Christmas disease, haemophilia B))                                                                                                 | 201  | 6.00e-51 |
|                      |         |                  | NP_000124.1 | coagulation factor IX; Coagulation factor IX (plasma thromboplastic component); Factor 9; Factor IX; Christmas factor                                                                          | 201  | 6.00e-51 |
|                      |         |                  | AAA52023.1  | coagulation factor IX precursor                                                                                                                                                                | 201  | 6.00e-51 |
|                      |         |                  | AAA52763.1  | factor IX (Christmas factor) precursor                                                                                                                                                         | 201  | 6.00e-51 |
|                      |         |                  | AAM96188.1  | coagulation factor IX (plasma thromboplastic component, Christmas disease, hemophilia B)                                                                                                       | 201  | 6.00e-51 |
|                      |         |                  | P00740      | FA9_HUMAN Coagulation factor IX precursor (Christmas factor)                                                                                                                                   | 201  | 6.00e-51 |
|                      |         |                  | KFHU        | coagulation factor IXa (EC 3.4.21.22) precursor                                                                                                                                                | 201  | 6.00e-51 |
|                      |         |                  | AAB59620.1  | factor IX                                                                                                                                                                                      | 201  | 6.00e-51 |
|                      |         |                  | AAA56822.1  | factor IX                                                                                                                                                                                      | 201  | 6.00e-51 |
|                      |         |                  | AAA98726.1  | factor IX                                                                                                                                                                                      | 199  | 3.00e-50 |
| U16162<br>AAC52197.1 | Mm.2212 | U:(C-IR)<br>2.16 | DAHUA1      | procollagen-proline dioxygenase (EC 1.14.11.2) alpha chain precursor, splice form 1                                                                                                            | 1001 | 0        |
|                      |         |                  | AAA59069.1  | alpha-subunit of prolyl 4-hydroxylase                                                                                                                                                          | 1001 | 0        |
|                      |         |                  | NP_000908.1 | procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase), alpha polypeptide I; procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase), alpha polypeptide 1 | 991  | 0        |
|                      |         |                  | AAA36534.1  | prolyl 4-hydroxylase alpha subunit (EC 1.14.11.2)                                                                                                                                              | 991  | 0        |
|                      |         |                  | P13674      | P4H1_HUMAN Prolyl 4-hydroxylase alpha-1 subunit precursor (4-PH alpha-1) (Procollagen-proline, 2-oxoglutarate-4-dioxygenase alpha-1 subunit)                                                   | 982  | 0        |
|                      |         |                  | DAHUA2      | procollagen-proline dioxygenase (EC 1.14.11.2) alpha chain precursor, splice form 2                                                                                                            | 982  | 0        |



|             |   |          |                               |             |                                                                                                                                                                                                    |     |       |
|-------------|---|----------|-------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|             |   |          |                               | AAA59068.1  | alpha-subunit of prolyl 4-hydroxylase                                                                                                                                                              | 982 | 0     |
|             |   |          |                               | AAH34998.1  | Similar to procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase), alpha polypeptide I                                                                                          | 982 | 0     |
|             |   |          |                               | AAA36535.1  | prolyl 4-hydroxylase alpha subunit (EC 1.14.11.2)                                                                                                                                                  | 971 | 0     |
|             |   |          |                               | NP_004190.1 | procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase), alpha polypeptide II; prolyl 4-hydroxylase, alpha polypeptide, type 2; prolyl-4-hydroxylase, alpha polypeptide, type II | 679 | 0     |
|             |   |          |                               | O15460      | P4H2_HUMAN Prolyl 4-hydroxylase alpha-2 subunit precursor (4-PH alpha-2) (Procollagen-proline, 2-oxoglutarate-4-dioxygenase alpha-2 subunit)                                                       | 679 | 0     |
|             |   |          |                               | AAB71339.1  | prolyl 4-hydroxylase alpha (II) subunit                                                                                                                                                            | 679 | 0     |
|             |   |          |                               | CAC85689.1  | Prolyl 4-hydroxylase alpha IIb subunit                                                                                                                                                             | 679 | 0     |
|             |   |          |                               | CAC85688.1  | Prolyl 4-hydroxylase alpha IIa subunit                                                                                                                                                             | 658 | 0     |
|             |   |          |                               | AAH35813.1  | Similar to procollagen-proline, 2-oxoglutarate 4-dioxygenase (proline 4-hydroxylase), alpha polypeptide II                                                                                         | 658 | 0     |
| NM_013743   |   |          |                               | NP_002603.1 | pyruvate dehydrogenase kinase, isoenzyme 4                                                                                                                                                         | 764 | 0     |
| NP_038771.1 | 3 | Mm. 1028 | U:(C-IR) 2.15<br>U:(C-D) 2.04 |             |                                                                                                                                                                                                    |     |       |
|             |   |          |                               | Q16654      | PDK4_HUMAN [Pyruvate dehydrogenase [lipoamide]] kinase isozyme 4, mitochondrial precursor (Pyruvate dehydrogenase kinase isoform 4)                                                                | 764 | 0     |
|             |   |          |                               | AAC50669.1  | pyruvate dehydrogenase kinase isoform 4                                                                                                                                                            | 764 | 0     |
|             |   |          |                               | AAC50670.1  | pyruvate dehydrogenase kinase isoform 4                                                                                                                                                            | 764 | 0     |
|             |   |          |                               | AAB67048.1  | pyruvate dehydrogenase kinase isoform 4                                                                                                                                                            | 764 | 0     |
|             |   |          |                               | AAH40239.1  | pyruvate dehydrogenase kinase, isoenzyme 4                                                                                                                                                         | 764 | 0     |
|             |   |          |                               | NP_002601.1 | pyruvate dehydrogenase kinase, isoenzyme 1                                                                                                                                                         | 562 | e-159 |
|             |   |          |                               | Q15118      | PDK1_HUMAN [Pyruvate dehydrogenase [lipoamide]] kinase isozyme 1, mitochondrial precursor (Pyruvate dehydrogenase kinase isoform 1)                                                                | 562 | e-159 |
|             |   |          |                               | I55465      | [pyruvate dehydrogenase (lipoamide)] kinase (EC 2.7.1.99) 1                                                                                                                                        | 562 | e-159 |
|             |   |          |                               | AAC42009.1  | pyruvate dehydrogenase kinase                                                                                                                                                                      | 562 | e-159 |

|             |         |                  |  |             |                                                                                                                                     |     |          |
|-------------|---------|------------------|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |                  |  | AAH39158.1  | Similar to pyruvate dehydrogenase kinase, isoenzyme 1                                                                               | 562 | e-159    |
|             |         |                  |  | 2203383A    | pyruvate dehydrogenase kinase:ISOTYPE=1                                                                                             | 562 | e-159    |
|             |         |                  |  | NP_002602.2 | pyruvate dehydrogenase kinase, isoenzyme 2                                                                                          | 556 | e-157    |
|             |         |                  |  | Q15119      | PDK2_HUMAN [Pyruvate dehydrogenase [lipoamide]] kinase isozyme 2, mitochondrial precursor (Pyruvate dehydrogenase kinase isoform 2) | 556 | e-157    |
|             |         |                  |  | AAH05811.1  | AAH05811 pyruvate dehydrogenase kinase, isoenzyme 2                                                                                 | 556 | e-157    |
|             |         |                  |  | AAH40478.1  | pyruvate dehydrogenase kinase, isoenzyme 2                                                                                          | 556 | e-157    |
|             |         |                  |  | I70159      | [pyruvate dehydrogenase (lipoamide)] kinase (EC 2.7.1.99) 2                                                                         | 554 | e-157    |
|             |         |                  |  | AAC42010.1  | pyruvate dehydrogenase kinase                                                                                                       | 554 | e-157    |
|             |         |                  |  | 2203383B    | pyruvate dehydrogenase kinase:ISOTYPE=2                                                                                             | 554 | e-157    |
|             |         |                  |  | NP_005382.1 | pyruvate dehydrogenase kinase, isoenzyme 3                                                                                          | 527 | e-149    |
|             |         |                  |  | Q15120      | PDK3_HUMAN [Pyruvate dehydrogenase [lipoamide]] kinase isozyme 3, mitochondrial precursor (Pyruvate dehydrogenase kinase isoform 3) | 527 | e-149    |
|             |         |                  |  | I70160      | [pyruvate dehydrogenase (lipoamide)] kinase (EC 2.7.1.99) 3                                                                         | 527 | e-149    |
|             |         |                  |  | AAC42011.1  | pyruvate dehydrogenase kinase                                                                                                       | 527 | e-149    |
|             |         |                  |  | AAH15948.1  | AAH15948 pyruvate dehydrogenase kinase, isoenzyme 3                                                                                 | 527 | e-149    |
|             |         |                  |  | 2203383C    | pyruvate dehydrogenase kinase:ISOTYPE=3                                                                                             | 527 | e-149    |
| NM_025806   |         |                  |  | NP_079105.1 | hypothetical protein FLJ22662                                                                                                       | 870 | 0        |
| NP_080082.1 | Mm.3311 | U:(C-IR)<br>2.15 |  |             | unnamed protein product                                                                                                             | 870 | 0        |
|             |         |                  |  | BAB15442.1  | AAH00909 hypothetical protein FLJ22662                                                                                              | 397 | e-110    |
|             |         |                  |  | XP_113725.2 | similar to RIKEN cDNA 1300012G16                                                                                                    | 271 | 2.00e-72 |
|             |         |                  |  | AAH30618.1  | similar to RIKEN cDNA 1300012G16                                                                                                    | 271 | 2.00e-72 |
| NM_008030   |         | U:(C-IR)<br>2.14 |  |             | FMO3_HUMAN Dimethylaniline monooxygenase [N-oxide forming] 3 (Hepatic                                                               |     |          |
| NP_032056.1 | Mm.2900 | U:(C-D)<br>2.22  |  | P31513      | flavin-containing monooxygenase 3) (FMO 3) (Dimethylaniline oxidase 3) (FMO II)                                                     | 847 | 0        |
|             |         |                  |  | AAC51932.1  | flavin containing monooxygenase 3                                                                                                   | 847 | 0        |

|  |  |  |  |             |                                                                                                                                                                  |     |       |
|--|--|--|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|  |  |  |  | CAA15908.1  | dJ127D3.1 (Hepatic Flavin-containing Monooxygenase 3 (Dimethylaniline Monooxygenase (N-Oxide forming) 3, EC1.14.13.8, Dimethylaniline Oxidase 3, FMO II, FMO 3)) | 847 | 0     |
|  |  |  |  | AAH32016.1  | flavin containing monooxygenase 3                                                                                                                                | 847 | 0     |
|  |  |  |  | NP_008825.2 | flavin containing monooxygenase 3; Flavin-containing monooxygenase-3                                                                                             | 846 | 0     |
|  |  |  |  | S51130      | dimethylaniline monooxygenase (N-oxide-forming) (EC 1.14.13.8) 3                                                                                                 | 846 | 0     |
|  |  |  |  | CAA87632.1  | flavin-containing monooxygenase 3 (FMO3)                                                                                                                         | 846 | 0     |
|  |  |  |  | A38228      | dimethylaniline monooxygenase (N-oxide-forming) (EC 1.14.13.8), hepatic 2                                                                                        | 795 | 0     |
|  |  |  |  | AAA86284.1  | flavoprotein                                                                                                                                                     | 795 | 0     |
|  |  |  |  | CAA15909.1  | dJ127D3.2 (Flavin-containing Monooxygenase family protein)                                                                                                       | 770 | 0     |
|  |  |  |  | Q99518      | FMO2_HUMAN Dimethylaniline monooxygenase [N-oxide forming] 2 (Pulmonary flavin-containing monooxygenase 2) (FMO 2) (Dimethylaniline oxidase 2) (FMO 1B1)         | 610 | e-174 |
|  |  |  |  | NP_002012.1 | flavin containing monooxygenase 1; Flavin-containing monooxygenase 1 (fetal liver)                                                                               | 580 | e-165 |
|  |  |  |  | Q01740      | FMO1_HUMAN DIMETHYLANILINE MONOOXYGENASE [N-OXIDE FORMING] 1 (FETAL HEPATIC FLAVIN-CONTAINING MONOOXYGENASE 1) (FMO 1) (DIMETHYLANILINE OXIDASE 1)               | 580 | e-165 |
|  |  |  |  | A40876      | dimethylaniline monooxygenase (N-oxide-forming) (EC 1.14.13.8), hepatic 1                                                                                        | 580 | e-165 |
|  |  |  |  | AAA52457.1  | flavin-containing monooxygenase                                                                                                                                  | 580 | e-165 |
|  |  |  |  | NP_001451.1 | flavin containing monooxygenase 2; Flavin-containing monooxygenase 2 (adult liver)                                                                               | 561 | e-159 |
|  |  |  |  | CAA70462.1  | flavin-containing monooxygenase 2                                                                                                                                | 561 | e-159 |
|  |  |  |  | CAA15910.1  | dJ127D3.3 (Flavin-containing Monooxygenase 2)                                                                                                                    | 561 | e-159 |
|  |  |  |  | AAH05894.1  | flavin containing monooxygenase 2                                                                                                                                | 561 | e-159 |
|  |  |  |  | P49326      | FMO5_HUMAN DIMETHYLANILINE MONOOXYGENASE [N-OXIDE FORMING] 5 (HEPATIC FLAVIN-CONTAINING MONOOXYGENASE 5) (FMO 5) (DIMETHYLANILINE OXIDASE 5)                     | 546 | e-155 |
|  |  |  |  | S71618      | dimethylaniline monooxygenase (N-oxide-forming) (EC 1.14.13.8) FMO5                                                                                              | 546 | e-155 |
|  |  |  |  | AAA67849.1  | flavin-containing monooxygenase 5                                                                                                                                | 546 | e-155 |
|  |  |  |  | NP_001452.1 | flavin containing monooxygenase 5                                                                                                                                | 545 | e-155 |

|             |                  |         |             |                                                                                              |     |          |
|-------------|------------------|---------|-------------|----------------------------------------------------------------------------------------------|-----|----------|
|             |                  |         | S51131      | flavin-containing monooxygenase 5 (FMO5)                                                     | 545 | e-155    |
|             |                  |         | CAA87633.1  | flavin-containing monooxygenase 5 (FMO5)                                                     | 545 | e-155    |
| NM_011012   |                  |         | NP_000904.1 | opiate receptor-like 1; kappa3-related opioid receptor                                       | 573 | e-163    |
| NP_035142.1 | U:(C-IR)<br>2.14 | Mm.2991 | P41146      | OPRX_HUMAN Nociceptin receptor (Orphanin FQ receptor) (Kappa-type 3 opioid receptor) (KOR-3) | 573 | e-163    |
|             |                  |         | S43087      | orphan opioid receptor ORL1                                                                  | 573 | e-163    |
|             |                  |         | CAA54386.1  | ORL1                                                                                         | 573 | e-163    |
|             |                  |         | AAA84913.1  | orphan opioid receptor                                                                       | 573 | e-163    |
|             |                  |         | AAK11714.1  | AF348323_1 nociceptin receptor                                                               | 573 | e-163    |
|             |                  |         | AAH38433.1  | opiate receptor-like 1                                                                       | 573 | e-163    |
|             |                  |         | AAL54890.1  | AF126470_1 KOR-3D                                                                            | 558 | e-159    |
|             |                  |         | AAA96251.1  | opioid receptor-like protein                                                                 | 509 | e-144    |
|             |                  |         | 2201468A    | opioid orphan receptor                                                                       | 509 | e-144    |
|             |                  |         | CAC17003.1  | dJ1022E24.1 (opiate receptor-like protein 1 (OPRL1))                                         | 445 | e-125    |
|             |                  |         | CAC15482.1  | dJ366F13.1 (opioid receptor mu 1)                                                            | 296 | 4.00e-80 |
|             |                  |         | P33372      | OPRM_HUMAN Mu-type opioid receptor (MOR-1)                                                   | 296 | 4.00e-80 |
|             |                  |         | I56553      | mu opiate receptor                                                                           | 296 | 4.00e-80 |
|             |                  |         | AAA73958.1  | opioid receptor                                                                              | 296 | 4.00e-80 |
|             |                  |         | 2108340A    | mu opioid receptor                                                                           | 296 | 4.00e-80 |
|             |                  |         | NP_000905.1 | opioid receptor, mu 1                                                                        | 296 | 4.00e-80 |
|             |                  |         | AAA20580.1  | Mu opiate receptor                                                                           | 296 | 4.00e-80 |
|             |                  |         | S65693      | opioid receptor mu variant MOR1A                                                             | 293 | 4.00e-79 |
|             |                  |         | AAB60354.1  | mu opioid receptor variant                                                                   | 293 | 4.00e-79 |
|             |                  |         | AAN87342.1  | DRG kappa 1 splice variant KOR 1A                                                            | 285 | 8.00e-77 |
|             |                  |         | P41143      | OPRD_HUMAN Delta-type opioid receptor (DOR-1)                                                | 285 | 1.00e-76 |
|             |                  |         | AAA83426.1  | delta opiate receptor                                                                        | 285 | 1.00e-76 |

|                          |              |                  |             |             |                                                                                                                                                               |  |     |          |
|--------------------------|--------------|------------------|-------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|                          |              |                  |             | CAA15671.1  | dJ212P9.1                                                                                                                                                     |  | 285 | 1.00e-76 |
| NM_015750<br>NP_056565.1 | Mm.4567<br>0 | U:(C-IR)<br>2.14 | NP_005374.1 | NP_005374.1 | sialidase 2; cytosolic sialidase; N-acetyl-alpha-neuraminidase 2                                                                                              |  | 539 | e-153    |
|                          |              |                  | Q9Y3R4      | Q9Y3R4      | NER2_HUMAN Sialidase 2 (Cytosolic sialidase) (N-acetyl-alpha-neuraminidase 2)                                                                                 |  | 539 | e-153    |
|                          |              |                  | CAB41449.1  | CAB41449.1  | neuraminidase; sialidase                                                                                                                                      |  | 539 | e-153    |
|                          |              |                  | NP_006647.2 | NP_006647.2 | sialidase 3; neuraminidase 3; ganglioside sialidase; N-acetyl-alpha-neuraminidase 3                                                                           |  | 267 | 4.00e-71 |
|                          |              |                  | CAB96131.1  | CAB96131.1  | Nuraminidase                                                                                                                                                  |  | 267 | 4.00e-71 |
|                          |              |                  | Q9UQ49      | Q9UQ49      | NER3_HUMAN Sialidase 3 (Membrane sialidase) (Ganglioside sialidase) (N-acetyl-alpha-neuraminidase 3)                                                          |  | 264 | 3.00e-70 |
|                          |              |                  | BAA82611.1  | BAA82611.1  | ganglioside sialidase                                                                                                                                         |  | 264 | 3.00e-70 |
|                          |              |                  | CAC81904.1  | CAC81904.1  | sialidase                                                                                                                                                     |  | 231 | 2.00e-60 |
|                          |              |                  | NP_542779.2 | NP_542779.2 | sialidase                                                                                                                                                     |  | 231 | 3.00e-60 |
| NM_031389<br>NP_113566.1 | Mm.8479<br>2 | U:(C-IR)<br>2.14 | XP_085972.4 | XP_085972.4 | similar to PYRIN-containing APAF1-like protein 4; PAAD and NACHT-containing protein 2; ribonuclease inhibitor 2                                               |  | 758 | 0        |
|                          |              |                  | NP_604393.1 | NP_604393.1 | PYRIN-containing APAF1-like protein 4; PAAD and NACHT-containing protein 2; ribonuclease inhibitor 2                                                          |  | 758 | 0        |
|                          |              |                  | Q96MN2      | Q96MN2      | NAL4_HUMAN NACHT-, LRR- and PYD-containing protein 4 (PAAD and NACHT-containing protein 2) (PYRIN-containing APAF1-like protein 4) (Ribonuclease inhibitor 2) |  | 758 | 0        |
|                          |              |                  | AAL35293.1  | AAL35293.1  | AF442488_1 NALP4                                                                                                                                              |  | 758 | 0        |
|                          |              |                  | AAL68396.1  | AAL68396.1  | PAAD and NACHT-containing protein 2                                                                                                                           |  | 758 | 0        |
|                          |              |                  | AAL87104.1  | AAL87104.1  | AF479747_1 PYRIN-containing APAF1-like protein 4                                                                                                              |  | 758 | 0        |
|                          |              |                  | BAB71254.1  | BAB71254.1  | unnamed protein product                                                                                                                                       |  | 758 | 0        |
|                          |              |                  | AAL88672.1  | AAL88672.1  | AF482706_1 ribonuclease inhibitor 2                                                                                                                           |  | 749 | 0        |
|                          |              |                  | XP_062261.4 | XP_062261.4 | similar to PYRIN-containing APAF1-like Protein 7                                                                                                              |  | 495 | e-139    |
|                          |              |                  | NP_659444.1 | NP_659444.1 | PYRIN-containing APAF1-like protein 6                                                                                                                         |  | 427 | e-119    |
|                          |              |                  | P59045      | P59045      | PYA6_HUMAN PYRIN-containing APAF1-like protein 6                                                                                                              |  | 427 | e-119    |
|                          |              |                  | AAM14632.1  | AAM14632.1  | PYRIN-containing APAF1-like protein 6                                                                                                                         |  | 427 | e-119    |

|                          |               |                  |  |             |                                                                                                                                                                                                     |     |          |
|--------------------------|---------------|------------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |               |                  |  | AAH34730.1  | PYRIN-containing APAF1-like protein 6                                                                                                                                                               | 427 | e-119    |
|                          |               |                  |  | AAH16443.1  | AAH16443 Unknown (protein for IMAGE:3448931)                                                                                                                                                        | 391 | e-108    |
|                          |               |                  |  | AAL78632.1  | AF468522_1 NALP3 long isoform                                                                                                                                                                       | 379 | e-104    |
|                          |               |                  |  | NP_004886.2 | cold autoinflammatory syndrome 1; chromosome 1 open reading frame 7; angiotensin/vasopressin receptor AII/AVP-like; cryopyrin; PYRIN-containing APAF1-like protein 1                                | 378 | e-104    |
|                          |               |                  |  | Q96P20      | CIS1_HUMAN Cold autoinflammatory syndrome 1 protein (Cryopyrin) (NACHT-, LRR- and PYD-containing protein 3) (PYRIN-containing APAF1-like protein 1) (Angiotensin/vasopressin receptor AII/AVP-like) | 378 | e-104    |
|                          |               |                  |  | AAL33908.1  | AF410477_1 cryopyrin                                                                                                                                                                                | 378 | e-104    |
|                          |               |                  |  | AAL12497.1  | cryopyrin                                                                                                                                                                                           | 378 | e-104    |
|                          |               |                  |  | AAL65136.1  | AF420469_1 PYRIN-containing APAF1-like protein 1                                                                                                                                                    | 378 | e-104    |
|                          |               |                  |  | XP_064988.5 | similar to PYRIN-containing APAF1-like protein 4; PAAD and NACHT-containing protein 2; ribonuclease inhibitor 2                                                                                     | 367 | e-101    |
| NM_025621<br>NP_079897.1 | Mm.1442<br>59 | U:(C-IR)<br>2.11 |  | XP_088993.1 | similar to RIKEN cDNA 2310050C09                                                                                                                                                                    | 229 | 5.00e-60 |
|                          |               |                  |  |             |                                                                                                                                                                                                     |     |          |
| NM_011377<br>NP_035507.1 | Mm.4775       | U:(C-IR)<br>2.09 |  | NP_005060.1 | single-minded (Drosophila) homolog 2 long isoform; human transcription factor SIM2, homolog of the Drosophila single-minded gene SIM1                                                               | 939 | 0        |
|                          |               |                  |  | Q14190      | SIM2_HUMAN Single-minded homolog 2                                                                                                                                                                  | 939 | 0        |
|                          |               |                  |  | AAB62396.1  | transcription factor SIM2 long form                                                                                                                                                                 | 939 | 0        |
|                          |               |                  |  | BAA89433.1  | single-minded 2 protein                                                                                                                                                                             | 939 | 0        |
|                          |               |                  |  | NP_033664.1 | single-minded (Drosophila) homolog 2 short isoform; human transcription factor SIM2, homolog of the Drosophila single-minded gene SIM1                                                              | 849 | 0        |
|                          |               |                  |  | AAB62397.1  | transcription factor SIM2 short form                                                                                                                                                                | 849 | 0        |
|                          |               |                  |  | CAA05055.1  | human SIM2                                                                                                                                                                                          | 729 | 0        |
|                          |               |                  |  | NP_005059.2 | single-minded (Drosophila) homolog 1; Single-minded, drosophila, homolog of, 1                                                                                                                      | 634 | 0        |
|                          |               |                  |  | P81133      | SIM1_HUMAN Single-minded homolog 1                                                                                                                                                                  | 629 | e-180    |
|                          |               |                  |  | AAB62395.1  | hSIM1                                                                                                                                                                                               | 629 | e-180    |

|            |          |                  |  |             |                                                                                                                                                   |      |          |
|------------|----------|------------------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|            |          |                  |  | A58520      | single-minded gene 2 protein                                                                                                                      | 462  | e-129    |
|            |          |                  |  | BAA12919.1  | Sim                                                                                                                                               | 461  | e-129    |
|            |          |                  |  | NP_071406.1 | basic-helix-loop-helix-PAS protein                                                                                                                | 295  | 3.00e-79 |
|            |          |                  |  | AAG35180.1  | AF164438_1 basic-helix-loop-helix-PAS protein                                                                                                     | 295  | 3.00e-79 |
|            |          |                  |  | BAB21221.1  | NPAS3 (MOP6)                                                                                                                                      | 295  | 5.00e-79 |
|            |          |                  |  | BAC53756.1  | NPAS3                                                                                                                                             | 295  | 5.00e-79 |
| AF319951   |          |                  |  |             |                                                                                                                                                   |      |          |
| AAL37178.1 | Mm.35253 | U:(C-IR)<br>2.08 |  | AAM73657.1  | solute carrier family 12 member 8                                                                                                                 | 1011 | 0        |
|            |          |                  |  | AAK94307.1  | solute carrier family 12 member 8                                                                                                                 | 766  | 0        |
|            |          |                  |  | AAH20506.1  | hypothetical protein FLJ23188                                                                                                                     | 370  | e-102    |
|            |          |                  |  | NP_078904.1 | solute carrier family 12 (potassium/chloride transporters), member 8; solute carrier family 12 (sodium/potassium/chloride transporters), member 8 | 369  | e-101    |
|            |          |                  |  | BAB15571.1  | unnamed protein product                                                                                                                           | 369  | e-101    |
|            |          |                  |  | NP_001037.1 | solute carrier family 12 (sodium/potassium/chloride transporters), member 2; Solute carrier family 12 (sodium/potassium/chloride transporters)    | 229  | 2.00e-59 |
|            |          |                  |  | P55011      | S122_HUMAN Solute carrier family 12 member 2 (Bumetanide-sensitive                                                                                | 229  | 2.00e-59 |
|            |          |                  |  | A57187      | bumetanide-sensitive Na-K-Cl cotransporter                                                                                                        | 229  | 2.00e-59 |
|            |          |                  |  | AAC50561.1  | bumetanide-sensitive Na-K-Cl cotransporter                                                                                                        | 229  | 2.00e-59 |
|            |          |                  |  | AAH33003.1  | Similar to solute carrier family 12 (sodium/potassium/chloride                                                                                    | 229  | 2.00e-59 |
|            |          |                  |  | NP_000329.1 | sodium potassium chloride cotransporter 2; Solute carrier family 12                                                                               | 223  | 1.00e-57 |
|            |          |                  |  | Q13621      | S121_HUMAN Solute carrier family 12 member 1 (Bumetanide-sensitive                                                                                | 223  | 1.00e-57 |
|            |          |                  |  | AAB07364.1  | bumetanide-sensitive Na-K-2Cl cotransporter                                                                                                       | 223  | 1.00e-57 |
|            |          |                  |  | P55017      | S123_HUMAN Solute carrier family 12 member 3 (Thiazide-sensitive sodium-chloride                                                                  | 201  | 4.00e-51 |
|            |          |                  |  | NP_000330.1 | solute carrier family 12 (sodium/chloride transporters), member 3; Solute carrier family 12 (sodium/potassium/chloride transporters).             | 201  | 4.00e-51 |
|            |          |                  |  | AAC50355.1  | thiazide-sensitive Na-Cl                                                                                                                          | 201  | 4.00e-51 |
|            |          |                  |  | G01202      | NaCl electroneutral Thiazide-sensitive cotransporter                                                                                              | 201  | 5.00e-51 |

|             |         |  |                  |             |                                                                                                                                       |      |          |
|-------------|---------|--|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |  |                  | CAA62613.1  | NaCl electroneutral Thiazide-sensitive cotransporter                                                                                  | 201  | 5.00e-51 |
| NM_008074   |         |  | U:(C-IR)<br>2.08 |             |                                                                                                                                       |      |          |
| NP_032100.1 | Mm.1345 |  |                  | NP_150092.1 | gamma-aminobutyric acid (GABA) A receptor, gamma 3                                                                                    | 841  | 0        |
|             |         |  |                  | AAB39369.1  | GABAA receptor gamma 3 subunit                                                                                                        | 841  | 0        |
|             |         |  |                  | Q99928      | GAC3_HUMAN Gamma-aminobutyric-acid receptor gamma-3 subunit precursor (GABA(A) receptor)                                              | 838  | 0        |
|             |         |  |                  | AAF99698.1  | GABAA receptor gamma 3 subunit                                                                                                        | 838  | 0        |
|             |         |  |                  | AAF63215.1  | GABAA receptor gamma 3 subunit                                                                                                        | 836  | 0        |
|             |         |  |                  | AAD50273.1  | gamma-aminobutyric acid A receptor gamma 2                                                                                            | 588  | e-167    |
|             |         |  |                  | NP_000807.1 | gamma-aminobutyric acid A receptor, gamma 2 precursor                                                                                 | 584  | e-166    |
|             |         |  |                  | P18507      | GAC2_HUMAN Gamma-aminobutyric-acid receptor gamma-2 subunit precursor (GABA(A) receptor)                                              | 584  | e-166    |
|             |         |  |                  | S03905      | gamma-aminobutyric acid/benzodiazepine receptor gamma-2 chain precursor                                                               | 584  | e-166    |
|             |         |  |                  | CAA33437.1  | GABA-A receptor gamma 2 subunit                                                                                                       | 584  | e-166    |
|             |         |  |                  | I506443A    | GABAA receptor gamma2                                                                                                                 | 584  | e-166    |
|             |         |  |                  | AAH31087.1  | similar to GAMMA-AMINOBUTYRIC-ACID RECEPTOR GAMMA-1 SUBUNIT PRECURSOR (GABA(A) RECEPTOR)                                              |      |          |
|             |         |  |                  | XP_094080.1 | similar to Gamma-aminobutyric-acid receptor gamma-1 subunit precursor (GABA(A) receptor) [Homo sapiens]                               | 576  | e-164    |
|             |         |  |                  | NP_004952.1 | gamma-aminobutyric acid (GABA) A receptor, epsilon, isoform 1 precursor                                                               | 576  | e-164    |
|             |         |  |                  | AAB49284.1  | GABA-A receptor epsilon subunit                                                                                                       | 378  | e-104    |
|             |         |  |                  | P78334      | GAE_HUMAN Gamma-aminobutyric-acid receptor epsilon subunit precursor (GABA(A) receptor)                                               | 378  | e-104    |
|             |         |  |                  | CAA70904.1  | GABA receptor epsilon subunit                                                                                                         | 378  | e-104    |
|             |         |  |                  | AAB94645.1  | GABA-A receptor epsilon subunit                                                                                                       | 378  | e-104    |
|             |         |  |                  | CAA70903.1  | GABRE                                                                                                                                 | 374  | e-103    |
| NM_010899   | Mm.1168 |  | U:(C-IR)<br>2.08 | Q13469      | NFC2_HUMAN Nuclear factor of activated T-cells, cytoplasmic 2 (T cell transcription factor NFAT1) (NFAT pre-existing subunit)(NF-ATp) | 1522 | 0        |
| NP_035029.1 | 02      |  |                  |             |                                                                                                                                       |      |          |



|             |         |          |  |             |                                                                                                                                   |      |          |
|-------------|---------|----------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |          |  | AAC50887.1  | transcription factor NFAT1 isoform C                                                                                              | 1522 | 0        |
|             |         |          |  | NP_036472.1 | nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 2; nuclear factor of activated T-cells, cytoplasmic 2     | 1487 | 0        |
|             |         |          |  | G02326      | transcription factor NFAT1 isoform B - human                                                                                      | 1487 | 0        |
|             |         |          |  | AAC50886.1  | transcription factor NFAT1 isoform B                                                                                              | 1487 | 0        |
|             |         |          |  | CAC00528.1  | dJ994O24.1 (nuclear factor of activated T-cells, cytoplasmic 2 (isoforms B and C))                                                | 835  | 0        |
|             |         |          |  | CAB54871.1  | dJ1009H6.1.2 (nuclear factor of activated T-cells, cytoplasmic 2, isoform C)                                                      | 649  | 0        |
|             |         |          |  | CAC00529.1  | dJ1009H6.1.1 (nuclear factor of activated T-cells, cytoplasmic 2, isoform B)                                                      | 615  | e-175    |
|             |         |          |  | 1A02        | N Chain N, Structure Of The Dna Binding Domains Of Nfat, Fos And Jun Bound To Dna                                                 | 567  | e-161    |
|             |         |          |  | AAD00451.1  | transcription factor                                                                                                              | 551  | e-156    |
|             |         |          |  | O95644      | NFC1_HUMAN Nuclear factor of activated T-cells, cytoplasmic 1 (NFAT transcription complex cytosolic component) (NF-ATc1) (NF-ATc) | 550  | e-156    |
|             |         |          |  | AAC50869.1  | nuclear factor of activated T cells                                                                                               | 523  | e-148    |
|             |         |          |  | NP_006153.2 | nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 1; nuclear factor of activated T-cells, cytoplasmic 1     | 521  | e-147    |
|             |         |          |  | AAD00450.1  | transcription factor                                                                                                              | 521  | e-147    |
|             |         |          |  | NP_037504.1 | cysteine knot superfamily 1, BMP antagonist 1; gremlin                                                                            | 311  | 2.00e-84 |
| NM_011824   | Mm.3046 | U:(C-IR) |  |             |                                                                                                                                   |      |          |
| NP_035954.1 | 5       | U:(C-D)  |  |             |                                                                                                                                   |      |          |
|             |         |          |  | AAC39725.1  | gremlin                                                                                                                           | 311  | 2.00e-84 |
|             |         |          |  | BAA84462.1  | gremlin homologue                                                                                                                 | 311  | 2.00e-84 |
|             |         |          |  | AAF06677.1  | gremlin                                                                                                                           | 311  | 2.00e-84 |
|             |         |          |  | AAG23891.1  | AF154054_1 DRM                                                                                                                    | 311  | 2.00e-84 |
|             |         |          |  | BAC04620.1  | unnamed protein product                                                                                                           | 254  | 3.00e-67 |
|             |         |          |  | BAC04643.1  | unnamed protein product                                                                                                           | 253  | 8.00e-67 |
|             |         |          |  |             |                                                                                                                                   |      |          |

|             |          |          |             |                                                                                          |  |  |  |     |          |
|-------------|----------|----------|-------------|------------------------------------------------------------------------------------------|--|--|--|-----|----------|
|             |          |          |             |                                                                                          |  |  |  |     |          |
| AF193796    | Mm.20706 | U:(C-IR) |             |                                                                                          |  |  |  |     |          |
| AAL09298.1  | 2        | 2.07     | XP_006804.2 | similar to Homeobox protein Hox-C13 (Hox-3G)                                             |  |  |  |     |          |
|             |          |          | NP_059106.2 | homeo box C13; homeobox protein Hox-C13; homeo box 3G                                    |  |  |  | 505 | e-142    |
|             |          |          | P31276      | HXCD_HUMAN Homeobox protein Hox-C13 (Hox-3G)                                             |  |  |  | 505 | e-142    |
|             |          |          | AAF73439.1  | HOXC13                                                                                   |  |  |  | 505 | e-142    |
|             |          |          | AAH02754.1  | homeo box C13                                                                            |  |  |  | 505 | e-142    |
|             |          |          | AAF67760.1  | homeoprotein C13                                                                         |  |  |  | 504 | e-142    |
|             |          |          | BAB14786.1  | unnamed protein product                                                                  |  |  |  | 280 | 7.00e-75 |
|             |          |          | P31271      | HXAD_HUMAN Homeobox protein Hox-A13                                                      |  |  |  | 218 | 4.00e-56 |
|             |          |          | AAC50993.1  | transcription factor HOXA13                                                              |  |  |  | 218 | 4.00e-56 |
|             |          |          | NP_000513.2 | homeobox protein A13; homeobox protein HOXA13; homeo box 1J; transcription factor HOXA13 |  |  |  | 218 | 4.00e-56 |
|             |          |          | NP_000514.1 | homeo box D13; homeo box 4I; homeobox protein Hox-D13                                    |  |  |  | 216 | 2.00e-55 |
|             |          |          | P35453      | HXDD_HUMAN Homeobox protein Hox-D13 (Hox-4I)                                             |  |  |  | 216 | 2.00e-55 |
|             |          |          | AAC51635.1  | HOXD13                                                                                   |  |  |  | 216 | 2.00e-55 |
|             |          |          | BAA95352.1  | homeobox transcription factor                                                            |  |  |  | 216 | 2.00e-55 |
| NM_008152   |          |          |             |                                                                                          |  |  |  |     |          |
| NP_032178.1 | Mm.2840  | U:(C-IR) | XP_007392.1 | similar to G protein-coupled receptor 65; T-cell death-associated gene 8                 |  |  |  | 527 | e-149    |
|             |          |          | AAH35633.1  | similar to G protein-coupled receptor                                                    |  |  |  | 527 | e-149    |
|             |          |          | NP_003599.1 | G protein-coupled receptor 65; T-cell death-associated gene 8                            |  |  |  | 521 | e-147    |
|             |          |          | AAC31794.1  | T cell-death associated protein                                                          |  |  |  | 521 | e-147    |
|             |          |          | S68207      | G protein-coupled receptor 6C.1                                                          |  |  |  | 196 | 8.00e-50 |
|             |          |          | AAA79061.1  | G protein-coupled receptor                                                               |  |  |  | 196 | 8.00e-50 |
|             |          |          | 2124311B    | G protein-coupled receptor                                                               |  |  |  | 196 | 8.00e-50 |
|             |          |          | NP_005273.1 | G protein-coupled receptor 4                                                             |  |  |  | 196 | 8.00e-50 |
|             |          |          | XP_009140.1 | similar to Probable G protein-coupled receptor GPR4 (GPR19)                              |  |  |  | 196 | 8.00e-50 |

|             |         |               |             |                                                                                     |                                                                                            |     |          |
|-------------|---------|---------------|-------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-----|----------|
|             |         |               |             | P46093                                                                              | GPR4_HUMAN Probable G protein-coupled receptor GPR4 (GPR19)                                | 196 | 8.00e-50 |
|             |         |               |             | A57641                                                                              | G protein-coupled receptor 4                                                               | 196 | 8.00e-50 |
|             |         |               |             | AAA98457.1                                                                          | G protein-coupled receptor                                                                 | 196 | 8.00e-50 |
|             |         |               |             | I53033                                                                              | G protein-coupled receptor                                                                 | 196 | 8.00e-50 |
|             |         |               |             | AAA63180.1                                                                          | G protein-coupled receptor                                                                 | 196 | 8.00e-50 |
| NM_008324   |         |               |             |                                                                                     | indoleamine-pyrrrole 2,3 dioxxygenase; Indoleamine 2,3-dioxygenase; indole 2,3-dioxygenase |     |          |
| NP_032350.1 | Mm.392  | U:(C-IR) 2.07 | NP_002155.1 |                                                                                     |                                                                                            | 499 | e-141    |
|             |         |               | P14902      | I23O_HUMAN Indoleamine 2,3-dioxygenase (IDO) (Indoleamine-pyrrrole 2,3-dioxygenase) |                                                                                            | 499 | e-141    |
|             |         |               | PC1161      | indoleamine-pyrrrole 2,3-dioxygenase (EC 1.13.11.42)                                |                                                                                            | 499 | e-141    |
|             |         |               | CAA35663.1  | indoleamine 2,3-dioxygenase                                                         |                                                                                            | 499 | e-141    |
|             |         |               | AAA36081.1  | indoleamine 2,3-dioxygenase (IDO) (EC 1.13.11.17)                                   |                                                                                            | 499 | e-141    |
|             |         |               | AAH27882.1  | indoleamine-pyrrrole 2,3 dioxxygenase                                               |                                                                                            | 499 | e-141    |
|             |         |               | XP_095645.4 | similar to indoleamine 2,3-dioxygenase                                              |                                                                                            | 313 | 4.00e-85 |
| NM_009827   |         |               |             |                                                                                     |                                                                                            |     |          |
| NP_033957.1 | Mm.3521 | U:(C-IR) 2.07 | NP_000721.1 | cholecystokinin A receptor                                                          |                                                                                            | 693 | 0        |
|             |         |               | P32238      | CCKR_HUMAN Cholecystokinin type A receptor (CCK-A receptor) (CCK-AR)                |                                                                                            | 693 | 0        |
|             |         |               | JN0692      | cholecystokinin type A receptor                                                     |                                                                                            | 693 | 0        |
|             |         |               | AAA35659.1  | cholecystokinin A receptor                                                          |                                                                                            | 693 | 0        |
|             |         |               | AAA02819.1  | cholecystokinin A receptor                                                          |                                                                                            | 693 | 0        |
|             |         |               | AAA91123.1  | cholecystokinin type A receptor                                                     |                                                                                            | 693 | 0        |
|             |         |               | BAA90879.1  | cholecystokinin type-A receptor                                                     |                                                                                            | 693 | 0        |
|             |         |               | 2118221A    | cholecystokinin A receptor                                                          |                                                                                            | 679 | 0        |
|             |         |               |             | GASR_HUMAN Gastrin/cholecystokinin type B receptor (CCK-B receptor) (CCK-BR)        |                                                                                            | 350 | 8.00e-96 |
|             |         |               | P32239      |                                                                                     |                                                                                            | 350 | 8.00e-96 |
|             |         |               | A47430      | gastrin/cholecystokinin receptor B, short splice form                               |                                                                                            | 350 | 8.00e-96 |

|             |         |          |  |             |                                                                                              |     |          |
|-------------|---------|----------|--|-------------|----------------------------------------------------------------------------------------------|-----|----------|
|             |         |          |  | AAA35660.1  | cholecystokinin receptor                                                                     | 350 | 8.00e-96 |
|             |         |          |  | AAA35657.1  | cholecystokinin-B/gastrin receptor                                                           | 350 | 8.00e-96 |
|             |         |          |  | AAC37528.1  | gastrin receptor                                                                             | 350 | 8.00e-96 |
|             |         |          |  | BAA02564.1  | cholecystokinin receptor                                                                     | 350 | 8.00e-96 |
|             |         |          |  | AAH00740.1  | AAH00740 cholecystokinin B receptor                                                          | 350 | 8.00e-96 |
|             |         |          |  | AAA91831.1  | cholecystokinin B receptor                                                                   | 348 | 2.00e-95 |
|             |         |          |  | AAB30766.2  | cholecystokinin B receptor                                                                   | 348 | 2.00e-95 |
|             |         |          |  | BAA04759.1  | cholecystokinin-B receptor/gastrin receptor                                                  | 348 | 4.00e-95 |
|             |         |          |  | AAC27510.1  | gastrin/cholecystokinin brain receptor                                                       | 345 | 3.00e-94 |
|             |         |          |  | AAK38351.1  | CCK-B/gastrin receptor variant                                                               | 243 | 1.00e-63 |
|             |         |          |  | AAN32829.   | AF441129_1 cholecystokinin-C receptor                                                        | 243 | 1.00e-63 |
|             |         |          |  | NP_000722.2 | cholecystokinin B receptor                                                                   | 241 | 5.00e-63 |
|             |         |          |  | AAF67174.1  | AF239668_1 CCK-B/gastrin receptor                                                            | 241 | 5.00e-63 |
| NM_013920   | Mm.4198 | U:(C-IR) |  | JC6095      | hepatocyte nuclear factor 4 gamma chain                                                      | 749 | 0        |
| NP_038948.1 | 5       | 2.07     |  |             |                                                                                              |     |          |
|             |         |          |  | 2208436B    | hepatocyte nuclear factor 4                                                                  | 749 | 0        |
|             |         |          |  | NP_004124.2 | hepatocyte nuclear factor 4, gamma                                                           | 739 | 0        |
|             |         |          |  | CAA89990.2  | hepatocyte nuclear factor 4 gamma (HNF4gamma)                                                | 739 | 0        |
|             |         |          |  | Q14541      | HN4G_HUMAN Hepatocyte nuclear factor 4-gamma (HNF-4-gamma)                                   | 738 | 0        |
|             |         |          |  | AAF00110.1  | hepatocyte nuclear factor 4 gamma                                                            | 738 | 0        |
|             |         |          |  | CAA61133.1  | Hepatocyte nuclear factor 4A                                                                 | 582 | e-166    |
|             |         |          |  | AAB48082.1  | hepatocyte nuclear factor 4-alpha                                                            | 579 | e-165    |
|             |         |          |  | NP_000448.2 | hepatocyte nuclear factor 4, alpha; transcription factor-14; hepatic nuclear factor 4, alpha | 579 | e-165    |
|             |         |          |  | JC6096      | hepatocyte nuclear factor 4 alpha2 chain                                                     | 579 | e-165    |
|             |         |          |  | CAA89989.1  | hepatocyte nuclear factor 4 alpha (HNF4alpha4)                                               | 579 | e-165    |
|             |         |          |  | 2208436A    | hepatocyte nuclear factor 4:ISOTYPE=alpha                                                    | 579 | e-165    |

|             |         |          |  |             |                                                                                                                                                                      |  |     |          |
|-------------|---------|----------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |          |  | CAC01303.1  | dJ1013A22.1 (hepatocyte nuclear factor 4, alpha)                                                                                                                     |  | 578 | e-165    |
|             |         |          |  | P41235      | HN4A_HUMAN Hepatocyte nuclear factor 4-alpha (HNF-4-alpha) (Transcription factor HNF-4) (Transcription factor 14)                                                    |  | 578 | e-165    |
|             |         |          |  | CAA54248.1  | hepatocyte nuclear factor 4                                                                                                                                          |  | 576 | e-164    |
|             |         |          |  | IC4937      | hepatocyte nuclear factor 4, splice form B                                                                                                                           |  | 575 | e-164    |
|             |         |          |  | CAA61134.1  | Hepatocyte nuclear factor 4B                                                                                                                                         |  | 575 | e-164    |
| NM_020028   | Mm.2325 | U:(C-IR) |  | NP_004711.2 | endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 4; G protein-coupled receptor; lysophosphatidic acid receptor EDG4; LPA receptor EDG4 |  | 470 | e-132    |
| NP_064412.1 | 3       | 2.07     |  | Q9HBW0      | EDG4_HUMAN Lysophosphatidic acid receptor Edg-4 (LPA receptor 2) (LPA-2)                                                                                             |  | 470 | e-132    |
|             |         |          |  | AAB61528.1  | R33799_1                                                                                                                                                             |  | 470 | e-132    |
|             |         |          |  | AAF43409.1  | AF233092_1 lysophosphatidic acid G protein-coupled receptor 4                                                                                                        |  | 470 | e-132    |
|             |         |          |  | AAH25695.1  | endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 4                                                                                     |  | 470 | e-132    |
|             |         |          |  | AAG28521.1  | AF197929_1 lysophosphatidic acid receptor EDG4                                                                                                                       |  | 468 | e-131    |
|             |         |          |  | AAC27728.1  | G protein-coupled receptor Edg-4                                                                                                                                     |  | 463 | e-130    |
|             |         |          |  | NP_001392.2 | lysophosphatidic acid receptor EDG2; ventricular zone gene 1; LPA receptor EDG2                                                                                      |  | 255 | 2.00e-67 |
|             |         |          |  | NP_476500.1 | lysophosphatidic acid receptor EDG2; ventricular zone gene 1; LPA receptor EDG2                                                                                      |  | 255 | 2.00e-67 |
|             |         |          |  | Q92633      | EDG2_HUMAN Lysophosphatidic acid receptor Edg-2 (LPA receptor 1) (LPA-1)                                                                                             |  | 255 | 2.00e-67 |
|             |         |          |  | CAA70686.1  | G protein-coupled receptor Edg-2                                                                                                                                     |  | 255 | 2.00e-67 |
|             |         |          |  | AAC00530.1  | Edg-2 receptor                                                                                                                                                       |  | 255 | 2.00e-67 |
|             |         |          |  | AAH30615.1  | Unknown (protein for MGC:33156)                                                                                                                                      |  | 255 | 2.00e-67 |
|             |         |          |  | AAH36034.1  | endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 2                                                                                     |  | 255 | 2.00e-67 |
|             |         |          |  | IC5293      | lysophosphatidic acid receptor                                                                                                                                       |  | 255 | 2.00e-67 |
|             |         |          |  | AAC51139.1  | lysophosphatidic acid receptor homolog                                                                                                                               |  | 255 | 2.00e-67 |
|             |         |          |  | CAA70687.1  | G protein-coupled receptor Edg-2                                                                                                                                     |  | 255 | 2.00e-67 |
|             |         |          |  | NP_036284.1 | endothelial cell differentiation gene 7; calcium-mobilizing lysophosphatidic acid receptor LP-A3; LPA receptor EDG7                                                  |  | 225 | 3.00e-58 |
|             |         |          |  | Q9UBY5      | EDG7_HUMAN Lysophosphatidic acid receptor Edg-7 (LPA receptor 3) (LPA-3)                                                                                             |  | 225 | 3.00e-58 |

|             |               |                                     |             |                                                                                                               |     |          |
|-------------|---------------|-------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------|-----|----------|
|             |               |                                     | AAD56311.1  | AF127138_1 lysophosphatidic acid G protein-coupled receptor                                                   | 225 | 3.00e-58 |
|             |               |                                     | AAF00530.1  | AF186380_1 calcium-mobilizing lysophosphatidic acid receptor LP-A3/Edg-7                                      | 225 | 3.00e-58 |
|             |               |                                     | AAF91291.1  | G-protein coupled receptor EDG-7                                                                              | 222 | 2.00e-57 |
| AK015988    |               |                                     |             |                                                                                                               |     |          |
| XP_129281.1 | Mm.40665      | U:(C-IR)<br>2.06                    | NP_079065.1 | hypothetical protein FLJ22529                                                                                 | 137 | 5.00e-89 |
|             |               |                                     | BAB15385.1  | unnamed protein product                                                                                       | 137 | 5.00e-89 |
| NM_009565   |               |                                     |             |                                                                                                               |     |          |
| NP_033591.1 | Mm.17068<br>4 | U:(C-IR)<br>2.05<br>U:(C-D)<br>2.13 | AAH12070.1  | Similar to kruppel-related zinc finger protein hcKrox                                                         | 593 | e-170    |
|             |               |                                     | NP_056956.1 | kruppel-related zinc finger protein hcKrox                                                                    | 592 | e-170    |
|             |               |                                     | AAC51847.1  | kruppel-related zinc finger protein hcKrox                                                                    | 592 | e-170    |
|             |               |                                     | XP_113971.1 | similar to HIV-1 inducer of short transcripts binding protein                                                 | 206 | 9.00e-53 |
|             |               |                                     | NP_056982.1 | HIV-1 inducer of short transcripts binding protein                                                            | 205 | 3.00e-52 |
|             |               |                                     | AAC72973.1  | HIV-1 inducer of short transcripts binding protein                                                            | 205 | 3.00e-52 |
| NM_008158   |               |                                     |             |                                                                                                               |     |          |
| NP_032184.1 | Mm.35009      | U:(C-IR)<br>2.05                    | NP_061844.1 | G protein-coupled receptor 27; super conserved receptor expressed in brain 1                                  | 453 | e-127    |
|             |               |                                     | Q9NS67      | GP27 HUMAN Probable G protein-coupled receptor GPR27 (Super conserved receptor expressed in brain 1)          | 453 | e-127    |
|             |               |                                     | JC7287      | G-protein coupled receptor, SREB1                                                                             | 453 | e-127    |
|             |               |                                     | BAA96645.1  | SREB1                                                                                                         | 453 | e-127    |
|             |               |                                     | AAH30577.1  | similar to G protein-coupled receptor 85                                                                      | 249 | 5.00e-66 |
|             |               |                                     | NP_061843.1 | G protein-coupled receptor 85; super conserved receptor expressed in brain 2                                  | 248 | 2.00e-65 |
|             |               |                                     | Q9NPD1      | GP85_HUMAN Probable G protein-coupled receptor GPR85 (Super conserved receptor expressed in brain 2) (PKrCx1) | 248 | 2.00e-65 |
|             |               |                                     | T47131      | G-protein coupled receptor, SREB2                                                                             | 248 | 2.00e-65 |
|             |               |                                     | CAB82307.1  | hypothetical protein                                                                                          | 248 | 2.00e-65 |

|             |         |          |  |             |                                                                                                               |  |     |          |
|-------------|---------|----------|--|-------------|---------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |          |  | BAA96646.1  | SREB2                                                                                                         |  | 248 | 2.00e-65 |
|             |         |          |  | AAF79956.1  | AF250237_1 orphan G protein-coupled receptor 85                                                               |  | 248 | 2.00e-65 |
|             |         |          |  | BAC05911.1  | seven transmembrane helix receptor                                                                            |  | 248 | 2.00e-65 |
|             |         |          |  | NP_061842.1 | super conserved receptor expressed in brain 3                                                                 |  | 233 | 3.00e-61 |
|             |         |          |  | Q9NS66      | SRB3 HUMAN Super conserved receptor expressed in brain 3                                                      |  | 233 | 3.00e-61 |
|             |         |          |  | JC7289      | G-protein coupled receptor, SREB3                                                                             |  | 233 | 3.00e-61 |
|             |         |          |  | BAA96647.1  | SREB3                                                                                                         |  | 233 | 3.00e-61 |
|             |         |          |  | AAH09861.1  | AAH09861 super conserved receptor expressed in brain 3                                                        |  | 233 | 3.00e-61 |
| NM_019513   | Mm.1170 | U:(C-IR) |  | NP_009151.1 | carbonic anhydrase VB, mitochondrial precursor; carbonic dehydratase                                          |  | 605 | e-173    |
| NP_062386.1 | 15      | 2.05     |  | Q9Y2D0      | CASB_HUMAN Carbonic anhydrase VB, mitochondrial precursor (Carbonate dehydratase VB) (CA-VB)                  |  | 605 | e-173    |
|             |         |          |  | BAA76671.1  | carbonic anhydrase VB                                                                                         |  | 605 | e-173    |
|             |         |          |  | AAH28142.1  | carbonic anhydrase VB, mitochondrial                                                                          |  | 605 | e-173    |
|             |         |          |  | NP_001730.1 | carbonic anhydrase VA, mitochondrial precursor; carbonic anhydrase V, mitochondrial; carbonic dehydratase     |  | 384 | e-106    |
|             |         |          |  | P35218      | CAH5_HUMAN Carbonic anhydrase VA, mitochondrial precursor (Carbonate dehydratase VA) (CA-VA)                  |  | 384 | e-106    |
|             |         |          |  | CRHU5       | carbonate dehydratase (EC 4.2.1.1) V precursor [validated]                                                    |  | 384 | e-106    |
|             |         |          |  | AAA02890.1  | carbonic anhydrase V                                                                                          |  | 384 | e-106    |
|             |         |          |  | AAB47048.1  | carbonic anhydrase V; CA V                                                                                    |  | 384 | e-106    |
|             |         |          |  | AAC99806.1  | carbonic anhydrase V                                                                                          |  | 384 | e-106    |
|             |         |          |  | IUGD        | Human Carbonic Anhydrase Ii[hcai] (E.C.4.2.1.1) Mutant With Ala 65 Replaced By Ser (A65s)                     |  | 286 | 4.00e-77 |
|             |         |          |  | IUGG        | Human Carbonic Anhydrase Ii[hcai] (E.C.4.2.1.1) Mutant With Ala 65 Replaced By Ser (A65s) - Orthorhombic Form |  | 286 | 4.00e-77 |
|             |         |          |  | IUGF        | Human Carbonic Anhydrase Ii [hcai] (E.C.4.2.1.1) Mutant With Ala 65 Replaced By Thr (A65t)                    |  | 285 | 9.00e-77 |

|  |  |  |  |      |                                                                                                                                                               |     |          |
|--|--|--|--|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  |  | 1G52 | A Chain A, Carbonic Anhydrase Ii Complexed With 4-(Aminosulfonyl)-N-[[2,3-Difluorophenyl)methyl]-Benzamide                                                    | 285 | 9.00e-77 |
|  |  |  |  | 1G54 | A Chain A, Carbonic Anhydrase Ii Complexed With 4-(Aminosulfonyl)-N-[[2,3,4,5,6-Pentafluorophenyl)methyl]-Benzamide                                           | 285 | 9.00e-77 |
|  |  |  |  | 1I8Z | A Chain A, Carbonic Anhydrase Ii Complexed With A1-6629 2h-Thieno[3,2-E]-1,2-Thiazine-6-Sulfonamide, 2-(3-Methoxyphenyl)-3-(4-Morpholinyl)-, 1,1-Dioxide      | 285 | 9.00e-77 |
|  |  |  |  | 1IF4 | A Chain A, Carbonic Anhydrase Ii Complexed With 4-Fluorobenzenesulfonamide                                                                                    | 285 | 9.00e-77 |
|  |  |  |  | 1G53 | A Chain A, Carbonic Anhydrase Ii Complexed With 4-(Aminosulfonyl)-N-[[2,6-Difluorophenyl)methyl]-Benzamide                                                    | 285 | 9.00e-77 |
|  |  |  |  | 1IF8 | A Chain A, Carbonic Anhydrase Ii Complexed With (S)-N-(3-Indol-1-Yl-2-Methyl-Propyl)-4-Sulfamoyl-Benzamide                                                    | 285 | 9.00e-77 |
|  |  |  |  | 1IF7 | A Chain A, Carbonic Anhydrase Ii Complexed With (R)-N-(3-Indol-1-Yl-2-Methyl-Propyl)-4-Sulfamoyl-Benzamide                                                    | 285 | 9.00e-77 |
|  |  |  |  | 1I90 | A Chain A, Carbonic Anhydrase Ii Complexed With A1-8520 2h-Thieno[3,2-E]-1,2-Thiazine-6-Sulfonamide, 4-Amino-3,4-Dihydro-2-(3-Methoxypropyl)-, 1,1-Dioxide, ® | 285 | 9.00e-77 |
|  |  |  |  | 1I91 | A Chain A, Carbonic Anhydrase Ii Complexed With A1-6619 2h-Thieno[3,2-E]-1,2-Thiazine-6-Sulfonamide, 2-(3-Hydroxyphenyl)-3-(4-Morpholinyl)-, 1,1-Dioxide      | 285 | 9.00e-77 |
|  |  |  |  | 1IF5 | A Chain A, Carbonic Anhydrase Ii Complexed With 2,6-Difluorobenzenesulfonamide                                                                                | 285 | 9.00e-77 |
|  |  |  |  | 1IF9 | A Chain A, Carbonic Anhydrase Ii Complexed With N-[2-(1h-Indol-5-Yl)-Butyl]-4-Sulfamoyl-Benzamide                                                             | 285 | 9.00e-77 |
|  |  |  |  | 1G1D | A Chain A, Carbonic Anhydrase Ii Complexed With 4-(Aminosulfonyl)-N-[[2-Fluorophenyl)methyl]-Benzamide                                                        | 285 | 9.00e-77 |
|  |  |  |  | 1IF6 | A Chain A, Carbonic Anhydrase Ii Complexed With 3,5-Difluorobenzenesulfonamide                                                                                | 285 | 9.00e-77 |
|  |  |  |  | 1AM6 | Carbonic Anhydrase Ii Inhibitor: Acetohydroxamate                                                                                                             | 285 | 9.00e-77 |
|  |  |  |  | 1F2W | A Chain A, The Mechanism Of Cyanamide Hydration Catalyzed By Carbonic Anhydrase Ii Revealed By Cryogenic X-Ray Diffraction                                    | 285 | 9.00e-77 |
|  |  |  |  | 1OKM | Carbonic Anhydrase Ii Complex With The 1okm Inhibitor 4-Sulfonamide-[1-(4-Aminobutane)]benzamide                                                              | 285 | 9.00e-77 |



|  |      |                                                                                                                              |     |          |
|--|------|------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  | 1BN1 | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BN4 | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BN3 | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BNN | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BNV | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BNM | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1CIL | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complexed With The Inhibitor Ets                                                         | 285 | 9.00e-77 |
|  | 2CA2 | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1) Complex With Thiocyanate Ion                            | 285 | 9.00e-77 |
|  | 3CA2 | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1) Complex With 3-Mercuri-4-Aminobenzenesulfonamide (AMS). | 285 | 9.00e-77 |
|  | 1CA2 | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1)                                                         | 285 | 9.00e-77 |
|  | 1BNT | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BNU | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1A42 | Human Carbonic Anhydrase Ii Complexed With Brinzolamide                                                                      | 285 | 9.00e-77 |
|  | 1BNW | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1BNQ | Carbonic Anhydrase Ii Inhibitor                                                                                              | 285 | 9.00e-77 |
|  | 1OKN | Carbonic Anhydrase Ii Complex With The 1okn Inhibitor 4-Sulfonamide-[1-(4-N-(5-Fluorescein Thiourea)butane)]                 | 285 | 9.00e-77 |
|  | 1OKL | Carbonic Anhydrase Ii Complex With The 1okl Inhibitor 5-Dimethylamino-Naphthalene-1-Sulfonamide                              | 285 | 9.00e-77 |
|  | 1CRA | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With 1,2,4-Triazole                                                              | 285 | 9.00e-77 |
|  | 1CAO | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With Hydrogen Sulfide                                                            | 285 | 9.00e-77 |
|  | 2CBA | Carbonic Anhydrase Ii (E.C.4.2.1.1) (50 Mm Tris, 3 M Ammonium Sulfate, Ph 7.8)                                               | 285 | 9.00e-77 |
|  | 2CBD | Carbonic Anhydrase Ii (E.C.4.2.1.1) (2.4 M Ammonium Sulfate, 0.3 M Sodium Bisulfite, Ph 7.3)                                 | 285 | 9.00e-77 |
|  | 2CBB | Carbonic Anhydrase Ii (E.C.4.2.1.1) (80 Mm Sodium Citrate, 2.4 M Ammonium Sulfate, Ph 6.0)                                   | 285 | 9.00e-77 |

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|  |  |  |  | IRAY        | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With Azide                                                       | 285 | 9.00e-77 |
|  |  |  |  | IRZB        | Carbonic Anhydrase Ii (E.C.4.2.1.1) With Zinc Replaced By By Cobalt(ii) At Ph 6.0                            | 285 | 9.00e-77 |
|  |  |  |  | 2CBE        | Carbonic Anhydrase Ii (E.C.4.2.1.1) (50 Mm Tris, 3 M Ammonium Sulfate, 2mm Dipicolinate, Ph 7.8)             | 285 | 9.00e-77 |
|  |  |  |  | 2CBC        | Carbonic Anhydrase Ii (E.C.4.2.1.1) (50 Mm Tris, 3 M Ammonium Sulfate, 0.2 Formate, Ph 7.6)                  | 285 | 9.00e-77 |
|  |  |  |  | ICAH        | Carbonic Anhydrase Ii (E.C.4.2.1.1) (Native Zinc Replaced By Cobalt) Complex With Bicarbonate                | 285 | 9.00e-77 |
|  |  |  |  | IRZC        | Carbonic Anhydrase Ii (E.C.4.2.1.1) With Zinc Replaced By Copper(ii)                                         | 285 | 9.00e-77 |
|  |  |  |  | IBCD        | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With Trifluoromethane Sulphonamide                               | 285 | 9.00e-77 |
|  |  |  |  | IRAZ        | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With Bromide                                                     | 285 | 9.00e-77 |
|  |  |  |  | IRZA        | Carbonic Anhydrase Ii (E.C.4.2.1.1) With Zinc Replaced By Cobalt(ii)                                         | 285 | 9.00e-77 |
|  |  |  |  | IRZD        | Carbonic Anhydrase Ii (E.C.4.2.1.1) With Zinc Replaced By Manganese(ii)                                      | 285 | 9.00e-77 |
|  |  |  |  | IRZE        | Carbonic Anhydrase Ii (E.C.4.2.1.1) With Zinc Replaced By Nickel(ii)                                         | 285 | 9.00e-77 |
|  |  |  |  | 1CAY        | Carbonic Anhydrase Ii (E.C.4.2.1.1) Complex With Acetate                                                     | 285 | 9.00e-77 |
|  |  |  |  | 5CAC        | Carbonic Anhydrase Form C (E.C.4.2.1.1) Complex With Hydrogen Sulfite                                        | 285 | 9.00e-77 |
|  |  |  |  | 4CAC        | Carbonic Anhydrase Form C (E.C.4.2.1.1) (Ph 6)                                                               | 285 | 9.00e-77 |
|  |  |  |  | 1BV3        | A Chain A, Human Carbonic Anhydrase Ii Complexed With Urea                                                   | 285 | 9.00e-77 |
|  |  |  |  | 1AVN        | Human Carbonic Anhydrase Ii Complexed With The Histamine Activator                                           | 285 | 9.00e-77 |
|  |  |  |  | 1LZV        | A Chain A, Site-Specific Mutant (Tyr7 Replaced With His) Of Human Carbonic Anhydrase Ii                      | 285 | 9.00e-77 |
|  |  |  |  | NP_000058.1 | carbonic anhydrase II; carbonate dehydratase II; carbonic dehydratase; carbonic anhydrase B                  | 285 | 9.00e-77 |
|  |  |  |  | P00918      | CAH2_HUMAN Carbonic anhydrase II (Carbonate dehydratase II) (CA-II) (Carbonic anhydrase C)                   | 285 | 9.00e-77 |
|  |  |  |  | CRHU2       | carbonate dehydratase (EC 4.2.1.1) II [validated]                                                            | 285 | 9.00e-77 |
|  |  |  |  | 1EOU        | A Chain A, Crystal Structure Of Human Carbonic Anhydrase Ii Complexed With An Anticonvulsant Sugar Sulfamate | 285 | 9.00e-77 |

|             |          |               |             |                                                                                                                                                               |     |          |
|-------------|----------|---------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |          |               | 1CNX        | Mol_id: 1; Molecule: Carbonic Anhydrase Ii; Chain: Null; Synonym: Carbonate Dehydratase, Hca Ii; Ec: 4.2.1.1; Heterogen: Benzenesulfonamide                   | 285 | 9.00e-77 |
|             |          |               | 1CNW        | Mol_id: 1; Molecule: Carbonic Anhydrase Ii; Chain: Null; Synonym: Carbonate Dehydratase, Hca Ii; Ec: 4.2.1.1; Heterogen: Ethylaminocarbonylbenzenesulfonamide | 285 | 9.00e-77 |
|             |          |               | 1CNY        | Mol_id: 1; Molecule: Carbonic Anhydrase Ii; Chain: Null; Synonym: Carbonate Dehydratase, Hca Ii; Ec: 4.2.1.1; Heterogen: Aminocarbonylbenzenesulfonamide      | 285 | 9.00e-77 |
|             |          |               | 4CA2        | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1)                                                                                          | 285 | 9.00e-77 |
|             |          |               | 1CA3        | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1) (pH 5.7)                                                                                 | 285 | 9.00e-77 |
|             |          |               | 1HCA        | Carbonic Anhydrase II (Carbonate Dehydratase) (HCA II) (E.C.4.2.1.1) (pH 6.5)                                                                                 | 285 | 9.00e-77 |
|             |          |               | CAA68426.1  | carbonic anhydrase II (AA 1-260)                                                                                                                              | 285 | 9.00e-77 |
|             |          |               | AAA51908.1  | carbonic anhydrase II                                                                                                                                         | 285 | 9.00e-77 |
|             |          |               | AAA51909.1  | carbonic anhydrase II                                                                                                                                         | 285 | 9.00e-77 |
|             |          |               | AAA51911.1  | carbonic anhydrase II                                                                                                                                         | 285 | 9.00e-77 |
|             |          |               | 1UGB        | Human Carbonic Anhydrase Ii[hcai] (E.C.4.2.1.1) Mutant With Ala 65 Replaced By Gly (A65g)                                                                     | 285 | 1.00e-76 |
|             |          |               | 1LG5        | A Chain A, Crystal Structure Analysis Of The Hca Ii Mutant T199p In Complex With Beta-Mercaptoethanol                                                         | 285 | 1.00e-76 |
|             |          |               | 1LG6        | A Chain A, Crystal Structure Analysis Of Hca Ii Mutant T199p In Complex With Thiocyanate                                                                      | 285 | 1.00e-76 |
|             |          |               | 1LGD        | A Chain A, Crystal Structure Analysis Of Hca Ii Mutant T199p In Complex With Bicarbonate                                                                      | 285 | 1.00e-76 |
| NM_008890   |          |               |             |                                                                                                                                                               |     |          |
| NP_032916.1 | Mm.57030 | U:(C-IR) 2.04 | NP_002677.1 | phenylethanolamine N-methyltransferase                                                                                                                        | 462 | e-130    |
|             |          |               | P11086      | PNMT_HUMAN Phenylethanolamine N-methyltransferase (PNMTase) (Noradrenaline N-methyltransferase)                                                               | 462 | e-130    |
|             |          |               | A28171      | phenylethanolamine N-methyltransferase (EC 2.1.1.28)                                                                                                          | 462 | e-130    |
|             |          |               | 1HNN        | B Chain B, Crystal Structure Of Human Pnmt Complexed With Sk&f 29661 And Adohcy(Sab)                                                                          | 462 | e-130    |

|             |         |                  |             |             |                                                                                                                                                                                                                      |      |       |
|-------------|---------|------------------|-------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|             |         |                  |             | 1HNN        | A Chain A, Crystal Structure Of Human Pnmt Complexed With Sk&f 29661 And Adohcy(Sah)                                                                                                                                 | 462  | e-130 |
|             |         |                  |             | AAA60130.1  | phenylethanolamine N-methyltransferase                                                                                                                                                                               | 462  | e-130 |
|             |         |                  |             | CAA36944.1  | phenylethanolamine n-methyltransferase                                                                                                                                                                               | 462  | e-130 |
|             |         |                  |             | AAH37246.1  | phenylethanolamine N-methyltransferase                                                                                                                                                                               | 462  | e-130 |
|             |         |                  |             | AAA60131.1  | phenylethanolamine N-methyltransferase                                                                                                                                                                               | 461  | e-130 |
| NM_008985   |         |                  |             |             | protein tyrosine phosphatase, receptor type, N precursor; islet cell antigen 2; islet cell antigen 512; islet cell autoantigen 3; protein tyrosine phosphatase-like N precursor                                      | 1389 | 0     |
| NP_033011.1 | Mm.2902 | U:(C-IR)<br>2.04 | NP_002837.1 | NP_002837.1 | PTPN_HUMAN Protein-tyrosine phosphatase-like N precursor (R-PTP-N) (PTP IA-2)(Islet cell antigen 512) (ICA 512) (Islet cell autoantigen 3)                                                                           | 1389 | 0     |
|             |         |                  | Q16849      | Q16849      | tyrosine phosphatase                                                                                                                                                                                                 | 1389 | 0     |
|             |         |                  | AAA90974.1  | AAA90974.1  | Islet Cell Antigen 512                                                                                                                                                                                               | 972  | 0     |
|             |         |                  | CAA44688.2  | CAA44688.2  | AAH07713 protein tyrosine phosphatase, receptor type, N                                                                                                                                                              | 972  | 0     |
|             |         |                  | AAH07713.1  | AAH07713.1  | islet cell antigen 512                                                                                                                                                                                               | 850  | 0     |
|             |         |                  | I37577      | I37577      | protein tyrosine phosphatase, receptor type, N polypeptide 2, isoform 2 precursor; protein tyrosine phosphatase receptor pi; phogrin; tyrosine phosphatase IA-2 beta; IAR/receptor-like protein-tyrosine phosphatase | 607  | e-173 |
|             |         |                  | NP_570857.1 | NP_570857.1 | protein tyrosine phosphatase receptor pi                                                                                                                                                                             | 607  | e-173 |
|             |         |                  | AAB68603.1  | AAB68603.1  | protein tyrosine phosphatase, receptor type, N polypeptide 2, isoform 1 precursor; protein tyrosine phosphatase receptor pi; phogrin; tyrosine phosphatase IA-2 beta; IAR/receptor-like protein-tyrosine phosphatase | 607  | e-173 |
|             |         |                  | NP_002838.1 | NP_002838.1 | PTPX_HUMAN Protein-tyrosine phosphatase X precursor (R-PTP-X) (Islet cell autoantigen related protein) (ICAAR) (IAR) (Phogrin)                                                                                       | 607  | e-173 |
|             |         |                  | Q92932      | Q92932      | phogrin precursor                                                                                                                                                                                                    | 607  | e-173 |
|             |         |                  | JC5062      | JC5062      | phogri                                                                                                                                                                                                               | 607  | e-173 |
|             |         |                  | AAC50742.1  | AAC50742.1  | transmembrane tyrosine phosphatase-like protein, ICAAR                                                                                                                                                               | 607  | e-173 |
|             |         |                  | JC5263      | JC5263      | Islet Cell Autoantigen Related                                                                                                                                                                                       | 607  | e-173 |
|             |         |                  | CAA69880    | CAA69880    | IAR/receptor-like protein-tyrosine phosphatase precursor                                                                                                                                                             | 607  | e-173 |
|             |         |                  | AAB63600.1  | AAB63600.1  |                                                                                                                                                                                                                      | 607  | e-173 |

|             |         |                  |  |             |                                                                                                                                                                                                                            |  |     |          |
|-------------|---------|------------------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |                  |  | BAA20841.2  | KIAA0387                                                                                                                                                                                                                   |  | 607 | e-173    |
|             |         |                  |  |             | protein tyrosine phosphatase, receptor type, N polypeptide 2, isoform 3 precursor;<br>protein tyrosine phosphatase receptor pi; phogrin; tyrosine phosphatase IA-2 beta;<br>IAR/receptor-like protein-tyrosine phosphatase |  | 579 | e-164    |
|             |         |                  |  | NP_570858.1 |                                                                                                                                                                                                                            |  |     |          |
|             |         |                  |  | AAH34040.1  | protein tyrosine phosphatase, receptor type, N polypeptide 2                                                                                                                                                               |  | 579 | e-164    |
|             |         |                  |  | AAK74066.1  | odd-skipped-related 2A protein                                                                                                                                                                                             |  | 481 | e-152    |
| NM_054049   | Mm.4633 | U:(C-IR)<br>2.03 |  |             |                                                                                                                                                                                                                            |  |     |          |
| NP_473390.1 | 6       | U:(C-IR)<br>2.46 |  |             |                                                                                                                                                                                                                            |  |     |          |
|             |         |                  |  | BAC11035.1  | unnamed protein product                                                                                                                                                                                                    |  | 484 | e-152    |
|             |         |                  |  | AAH16936.1  | AAH16936 odd-skipped-related 2A protein                                                                                                                                                                                    |  | 509 | e-144    |
|             |         |                  |  | NP_443727.1 | odd-skipped-related 2A protein                                                                                                                                                                                             |  | 507 | e-143    |
|             |         |                  |  | AAK74067.1  | odd-skipped-related 2B protein                                                                                                                                                                                             |  | 507 | e-143    |
|             |         |                  |  | XP_059439.2 | similar to odd-skipped related 1 (Drosophila); odd-skipped related gene; odz (odd<br>Oz/ten-m) homolog (Drosophila) related 1                                                                                              |  | 347 | 2.00e-95 |
|             |         |                  |  | NP_660303.1 | similar to odd-skipped related 1 (Drosophila); odd-skipped related gene; odz (odd<br>Oz/ten-m) homolog (Drosophila) related 1                                                                                              |  | 347 | 2.00e-95 |
|             |         |                  |  | AAH25712.1  | Similar to odd-skipped related 1 (Drosophila)                                                                                                                                                                              |  | 347 | 2.00e-95 |
|             |         |                  |  | BAB92079.1  | zinc finger transcription factor                                                                                                                                                                                           |  | 347 | 2.00e-95 |
|             |         |                  |  | BAC11079.1  | unnamed protein product                                                                                                                                                                                                    |  | 347 | 2.00e-95 |
| NM_007924   |         |                  |  |             |                                                                                                                                                                                                                            |  |     |          |
| NP_031950.1 | Mm.1552 | U:(C-IR)<br>2.03 |  | NP_006523.1 | ELL gene (11-19 lysine-rich leukemia gene)                                                                                                                                                                                 |  | 880 | 0        |
|             |         |                  |  | P55199      | ELL_HUMAN RNA polymerase II elongation factor ELL (Eleven-nineteen<br>lysine-rich leukemia protein)                                                                                                                        |  | 880 | 0        |
|             |         |                  |  | I38880      | eleven-nineteen lysine-rich leukemia gene (ELL) protein                                                                                                                                                                    |  | 880 | 0        |
|             |         |                  |  | AAA57120.1  | ELL                                                                                                                                                                                                                        |  | 880 | 0        |
|             |         |                  |  | AAB34056.1  | MEN chimeric transcription factor                                                                                                                                                                                          |  | 803 | 0        |
|             |         |                  |  | NP_036213.1 | ELL-related RNA polymerase II, elongation factor                                                                                                                                                                           |  | 371 | e-102    |

|             |         |                  |             |                                                                                                                     |  |     |          |
|-------------|---------|------------------|-------------|---------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |                  | O00472      | ELL2_HUMAN RNA polymerase II elongation factor ELL2                                                                 |  | 371 | e-102    |
|             |         |                  | AAC51232.1  | RNA polymerase II elongation factor ELL2                                                                            |  | 371 | e-102    |
|             |         |                  | AAH28412.1  | ELL-RELATED RNA POLYMERASE II, ELONGATION FACTOR                                                                    |  | 371 | e-102    |
| NM_008521   |         |                  |             |                                                                                                                     |  |     |          |
| NP_032547.1 | Mm.4088 | U:(C-IR)<br>2.03 | AAH29498.1  | leukotriene C4 synthase                                                                                             |  | 204 | 5.00e-53 |
|             |         |                  | JC5398      | leukotriene C4 synthase (EC 6.-.-.-)                                                                                |  | 204 | 7.00e-53 |
|             |         |                  | NP_665874.1 | leukotriene C4 synthase isoform 1                                                                                   |  | 204 | 7.00e-53 |
|             |         |                  | Q16873      | LC4S_HUMAN Leukotriene C4 synthase (Leukotriene-C(4) synthase) (LTC4 synthase)                                      |  | 204 | 7.00e-53 |
|             |         |                  | I38595      | leukotriene-C4 synthase (EC 2.5.1.37)                                                                               |  | 204 | 7.00e-53 |
|             |         |                  | AAA20467.1  | leukotriene C4 synthase                                                                                             |  | 204 | 7.00e-53 |
|             |         |                  | AAA50555.1  | leukotriene-C4 synthase                                                                                             |  | 204 | 7.00e-53 |
|             |         |                  | AAC50476.1  | leukotriene C4 synthase                                                                                             |  | 204 | 7.00e-53 |
|             |         |                  | AAB06723.1  | leukotriene C4 synthase                                                                                             |  | 204 | 7.00e-53 |
| NM_010780   |         | U:(C-IR)<br>2.03 | NP_001827.1 | chymase 1, mast cell preproprotein; chymase, mast cell; chymase, heart; mast cell protease I                        |  | 345 | 9.00e-95 |
| NP_034910.1 | Mm.1252 |                  | P23946      | MCT1_HUMAN Chymase precursor (Mast cell protease I)                                                                 |  | 345 | 9.00e-95 |
|             |         |                  | KYHUUM      | chymase (EC 3.4.21.39) precursor [validated]                                                                        |  | 345 | 9.00e-95 |
|             |         |                  | AAA52019.1  | chymase                                                                                                             |  | 345 | 9.00e-95 |
|             |         |                  | AAA52020.1  | mast cell chymase                                                                                                   |  | 345 | 9.00e-95 |
|             |         |                  | AAA52021.1  | chymase                                                                                                             |  | 345 | 9.00e-95 |
|             |         |                  | IKLT        | Crystal Structure Of Pmsf-Treated Human Chymase At 1.9 Angstroms Resolution                                         |  | 333 | 2.00e-91 |
|             |         |                  | AAB26828.1  | chymase                                                                                                             |  | 333 | 2.00e-91 |
|             |         |                  | I914144A    | chymase                                                                                                             |  | 333 | 2.00e-91 |
|             |         |                  | IPJP        | A Chain A, The 2.2 A Crystal Structure Of Human Chymase In Complex With Succinyl-Ala-Ala-Pro-Phe-Chloromethylketone |  | 331 | 1.00e-90 |

|                            |         |                  |             |                                                                                                                                                                                                                          |  |     |          |
|----------------------------|---------|------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
| NM_021470<br>NP_067445.1 2 | Mm.8735 | U:(C-IR)<br>2.03 | NP_112198.1 | ring finger protein 32                                                                                                                                                                                                   |  | 522 | e-148    |
|                            |         |                  | CAB66808.1  | hypothetical protein                                                                                                                                                                                                     |  | 522 | e-148    |
|                            |         |                  | AAG50281.1  | AF325690_1 FKSG33                                                                                                                                                                                                        |  | 522 | e-148    |
|                            |         |                  | AAM18664.1  | AF441222_1 ring finger protein RNF32                                                                                                                                                                                     |  | 522 | e-148    |
|                            |         |                  | AAD43189.1  | AC005534_2 supported by human ESTs AA412402 (NID:g2070990) NH44021 (NID:g1182549), mouse EST AA065933 (NID:g1562789), and genscan                                                                                        |  | 445 | e-125    |
|                            |         |                  | AAH15416.1  | AAH15416 Similar to hypothetical protein DKFZp434C135                                                                                                                                                                    |  | 319 | 4.00e-87 |
|                            |         |                  | AAH28120.1  | Similar to ring finger protein 32                                                                                                                                                                                        |  | 310 | 2.00e-84 |
| NM_007513<br>NP_031539.1   | Mm.5255 | U:(C-IR)<br>2.02 | NP_003036.1 | solute carrier family 7 (cationic amino acid transporter, y+ system), member 1; ecotropic retroviral receptor; Solute carrier family 7 (cationic amino acid transporter, y+ system);; amino acid transporter, cationic 1 |  | 990 | 0        |
|                            |         |                  | P30825      | CTR1_HUMAN High-affinity cationic amino acid transporter-1 (CAT-1) (CAT1) (System Y+ basic amino acid transporter) (Ecotropic retroviral leukemia receptor homolog) (ERR) (Ecotropic retrovirus receptor homolog)        |  | 990 | 0        |
|                            |         |                  | CAA41869.1  | retroviral receptor                                                                                                                                                                                                      |  | 990 | 0        |
|                            |         |                  | AAC27721.1  | cationic amino acid transporter                                                                                                                                                                                          |  | 990 | 0        |
|                            |         |                  | S29685      | retroviral receptor                                                                                                                                                                                                      |  | 988 | 0        |
|                            |         |                  | CAA40560.1  | RECIL                                                                                                                                                                                                                    |  | 988 | 0        |
|                            |         |                  | P52569      | CTR2_HUMAN Low-affinity cationic amino acid transporter-2 (CAT-2) (CAT2)                                                                                                                                                 |  | 654 | 0        |
|                            |         |                  | BAA06271.1  | cationic amino acid transporter 2                                                                                                                                                                                        |  | 654 | 0        |
|                            |         |                  | NP_003037.1 | solute carrier family 7 (cationic amino acid transporter, y+ system), member 2; Solute carrier family 7 (cationic amino acid transporter, y+ system);; amino acid transporter, cationic 2                                |  | 648 | 0        |
|                            |         |                  | AAB62810.1  | hCAT-2A                                                                                                                                                                                                                  |  | 648 | 0        |
|                            |         |                  | NP_116192.2 | solute carrier family 7 (cationic amino acid transporter, y+ system), member 3                                                                                                                                           |  | 640 | 0        |
|                            |         |                  | AAL37184.1  | cationic amino acid transporter                                                                                                                                                                                          |  | 640 | 0        |
|                            |         |                  | BAC11353.1  | unnamed protein product                                                                                                                                                                                                  |  | 640 | 0        |
|                            |         |                  | AAH33816.1  | solute carrier family 7 (cationic amino acid transporter, y+ system), member 3                                                                                                                                           |  | 639 | 0        |

|             |          |                  |  |             |                                                                                              |     |          |
|-------------|----------|------------------|--|-------------|----------------------------------------------------------------------------------------------|-----|----------|
|             |          |                  |  | BAC11253.1  | unnamed protein product                                                                      | 637 | 0        |
|             |          |                  |  | BAB55118.1  | unnamed protein product                                                                      | 421 | e-117    |
|             |          |                  |  | XP_036892.1 | similar to Cationic amino acid transporter-4 (CAT-4) (CAT4)                                  | 411 | e-114    |
|             |          |                  |  | AAH08814.1  | Unknown (protein for MGC:10733)                                                              | 411 | e-114    |
|             |          |                  |  | NP_004164.1 | solute carrier family 7 (cationic amino acid transporter, y+ system), member 4               | 393 | e-109    |
|             |          |                  |  | O43246      | CTR4_HUMAN Cationic amino acid transporter-4 (CAT-4) (CAT4)                                  | 393 | e-109    |
|             |          |                  |  | CAA04263.1  | cationic amino acid transporter 3                                                            | 393 | e-109    |
| NM_007962   |          |                  |  |             |                                                                                              |     |          |
| NP_031988.1 | Mm.33240 | U:(C-IR)<br>2.02 |  | NP_005788.1 | epithelial V-like antigen 1 precursor                                                        | 330 | 3.00e-90 |
|             |          |                  |  | NP_658911.1 | epithelial V-like antigen 1 precursor                                                        | 330 | 3.00e-90 |
|             |          |                  |  | O60487      | EVA1_HUMAN Epithelial V-like antigen 1 precursor                                             | 330 | 3.00e-90 |
|             |          |                  |  | AAC39762.1  | epithelial V-like antigen precursor                                                          | 330 | 3.00e-90 |
|             |          |                  |  | AAF87240.1  | AF275945_1 epithelial V-like antigen 1                                                       | 330 | 3.00e-90 |
|             |          |                  |  | AAG23183.1  | AF304447_1 epithelial V-like antigen 1                                                       | 330 | 3.00e-90 |
|             |          |                  |  | AAH17774.1  | epithelial V-like antigen 1                                                                  | 330 | 3.00e-90 |
| NM_010393   | Mm.1960  | U:(C-IR)<br>2.02 |  | P30461      | IB05_HUMAN HLA class I histocompatibility antigen, B-13 B*1301 alpha chain precursor (B13.1) | 420 | e-117    |
| NP_034523.1 | 32       |                  |  | I54442      | MHC class I histocompatibility antigen HLA-B13 precursor                                     | 420 | e-117    |
|             |          |                  |  | AAA52657.1  | MHC HLA-B13 precursor                                                                        | 420 | e-117    |
|             |          |                  |  | AAA59660.1  | MHC HLA-B13 chain                                                                            | 420 | e-117    |
|             |          |                  |  | BAA08822.1  | HLA-B*1302 antigen                                                                           | 420 | e-117    |
|             |          |                  |  | CAC17136.1  | MHC class I antigen                                                                          | 420 | e-117    |
|             |          |                  |  | CAC17137.1  | MHC class I antigen                                                                          | 418 | e-117    |
|             |          |                  |  | A45850      | MHC class I histocompatibility antigen HLA-B13.1                                             | 418 | e-117    |
|             |          |                  |  | AAA59627.1  | HLA-B13 protein                                                                              | 418 | e-117    |
|             |          |                  |  | BAA08821.1  | HLA-B*1301 antigen                                                                           | 418 | e-117    |



|        |                |                  |  |             |                                                                                                                                                                                                              |      |       |
|--------|----------------|------------------|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|        |                |                  |  | AAA59618.1  | glycosylation aa 86, alpha domain 1 aa 1-24, alpha domain 2 aa 25-114, alpha domain 3 aa 207-298                                                                                                             | 418  | e-117 |
|        |                |                  |  | CAC29063.1  | MHC class I antigen                                                                                                                                                                                          | 418  | e-117 |
|        |                |                  |  | AAA73509.1  | MHC class I lymphocyte antigen                                                                                                                                                                               | 416  | e-116 |
|        |                |                  |  | AAD00010.1  | HLA-B38                                                                                                                                                                                                      | 416  | e-116 |
|        |                |                  |  | AAB06829.1  | MHC antigen                                                                                                                                                                                                  | 415  | e-116 |
|        |                |                  |  | AAA98506.1  | MHC class I antigen HLA-B precursor                                                                                                                                                                          | 414  | e-116 |
|        |                |                  |  | I84488      | lymphocyte antigen                                                                                                                                                                                           | 413  | e-115 |
|        |                |                  |  | AAC31793.1  | HLA class I antigen HLA-B                                                                                                                                                                                    | 412  | e-115 |
|        |                |                  |  | P30476      | IB32_HUMAN HLA class I histocompatibility antigen, B-39 B*3902 alpha chain precursor (B39.2)                                                                                                                 | 412  | e-115 |
|        |                |                  |  | I68850      | MHC class I histocompatibility antigen precursor                                                                                                                                                             | 412  | e-115 |
|        |                |                  |  | AAA52659.1  | lymphocyte antigen                                                                                                                                                                                           | 412  | e-115 |
|        |                |                  |  | AAA87396.1  | MHC class I antigen                                                                                                                                                                                          | 412  | e-115 |
| X99104 | Mm. 1976<br>95 | U:(C-IR)<br>2.02 |  | NP_084656.1 | GLI-Kruppel family member GLI2 isoform beta; oncogene GLI2; tax helper protein 2; zinc finger protein GLI2; tax-responsive element-25-bp sequence binding protein; tax-responsive element-2 holding protein  | 1821 | 0     |
|        |                |                  |  | BAA25666.1  | hGLI2                                                                                                                                                                                                        | 1821 | 0     |
|        |                |                  |  | NP_084655.1 | GLI-Kruppel family member GLI2 isoform alpha; oncogene GLI2; tax helper protein 2; zinc finger protein GLI2; tax-responsive element-25-bp sequence binding protein; tax-responsive element-2 holding protein | 1810 | 0     |
|        |                |                  |  | P10070      | GLI2_HUMAN Zinc finger protein GLI2 (Tax helper protein)                                                                                                                                                     | 1810 | 0     |
|        |                |                  |  | BAA25665.1  | hGLI2                                                                                                                                                                                                        | 1810 | 0     |
|        |                |                  |  | NP_005261.1 | GLI-Kruppel family member GLI2 isoform delta; oncogene GLI2; tax helper protein 2; zinc finger protein GLI2; tax-responsive element-25-bp sequence binding protein; tax-responsive element-2 holding protein | 1263 | 0     |
|        |                |                  |  | BAA25668.1  | hGLI2                                                                                                                                                                                                        | 1263 | 0     |

|             |         |  |                  |             |                                                                                                                                                                                                              |      |       |
|-------------|---------|--|------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|             |         |  |                  | NP_084657.1 | GLI-Kruppel family member GLI2 isoform gamma; oncogene GLI2; tax helper protein 2; zinc finger protein GLI2; tax-responsive element-25-bp sequence binding protein; tax-responsive element-2 holding protein | 1252 | 0     |
|             |         |  |                  | BAA25667.1  | hGLI2                                                                                                                                                                                                        | 1252 | 0     |
|             |         |  |                  | NP_000159.2 | GLI-Kruppel family member GLI3; oncogene GLI3; DNA-binding protein; zinc finger protein GLI3                                                                                                                 | 1043 | 0     |
|             |         |  |                  | CAB59315.1  | GLI3 protein                                                                                                                                                                                                 | 1043 | 0     |
|             |         |  |                  | P10071      | GLI3_HUMAN Zinc finger protein GLI3                                                                                                                                                                          | 1004 | 0     |
|             |         |  |                  | A35927      | 190K DNA-binding protein GLI3                                                                                                                                                                                | 1004 | 0     |
|             |         |  |                  | AAA52564.1  | DNA-binding protein                                                                                                                                                                                          | 1004 | 0     |
|             |         |  |                  | BAA03568.1  | Tax helper protein 1                                                                                                                                                                                         | 730  | 0     |
|             |         |  |                  | BAA03569.1  | Tax helper protein 2                                                                                                                                                                                         | 719  | 0     |
|             |         |  |                  | NP_005260.1 | glioma-associated oncogene homolog                                                                                                                                                                           | 445  | e-124 |
|             |         |  |                  | P08151      | GLI1_HUMAN Zinc finger protein GLI1 (Glioma-associated oncogene) (Oncogene GLI1)                                                                                                                             | 445  | e-124 |
|             |         |  |                  | TVHUGL      | transforming protein gli                                                                                                                                                                                     | 445  | e-124 |
|             |         |  |                  | CAA30297.1  | GLI protein (AA 1-1106)                                                                                                                                                                                      | 445  | e-124 |
|             |         |  |                  | AAH13000.1  | AAH13000 Similar to glioma-associated oncogene homolog (zinc finger protein)                                                                                                                                 | 445  | e-124 |
|             |         |  |                  | AAM13391.1  | GLI1                                                                                                                                                                                                         | 445  | e-124 |
|             |         |  |                  | BAA19667.1  | Similar to Rat growth factor Arc (U19866)                                                                                                                                                                    | 765  | 0     |
| NM_018790   | Mm.2540 |  | U:(C-IR)<br>2.01 |             |                                                                                                                                                                                                              |      |       |
| NP_061260.1 | 5       |  | U:(C-D)<br>2.34  |             |                                                                                                                                                                                                              |      |       |
|             |         |  |                  | NP_056008.1 | activity-regulated cytoskeleton-associated protein                                                                                                                                                           | 763  | 0     |
|             |         |  |                  | AAF07185.1  | AF193421_1 ARC                                                                                                                                                                                               | 763  | 0     |
|             |         |  |                  | AAG33705.1  | AF248637_1 activity-regulated cytoskeleton-associated protein                                                                                                                                                | 763  | 0     |
|             |         |  |                  | AAH12321.1  | AAH12321 Similar to activity-regulated cytoskeleton-associated protein                                                                                                                                       | 763  | 0     |

|                          |               |                                     |             |                                                                                                                                           |      |          |
|--------------------------|---------------|-------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| NM_020043<br>NP_064427.1 | Mm.1437<br>41 | U:(C-IR)<br>2.01<br>U:(C-D)<br>2.17 | NP_066013.1 | DDM36                                                                                                                                     | 2055 | 0        |
|                          |               |                                     | BAB86306.1  | hDDM36                                                                                                                                    | 2055 | 0        |
|                          |               |                                     | BAB13454.1  | KIAA1628 protein                                                                                                                          | 1539 | 0        |
|                          |               |                                     | AAC51287.1  | neogenin                                                                                                                                  | 260  | 2.00e-68 |
|                          |               |                                     | NP_002490.1 | neogenin homolog 1 (chicken); neogenin (chicken) homolog 1                                                                                | 260  | 2.00e-68 |
|                          |               |                                     | Q92859      | NEO1_HUMAN Neogenin precursor                                                                                                             | 260  | 2.00e-68 |
|                          |               |                                     | AAB17263.1  | neogenin                                                                                                                                  | 260  | 2.00e-68 |
|                          |               |                                     | NP_005206.1 | deleted in colorectal carcinoma                                                                                                           | 226  | 2.00e-58 |
|                          |               |                                     | P43146      | DCC_HUMAN Tumor suppressor protein DCC precursor (Colorectal cancer suppressor)                                                           | 226  | 2.00e-58 |
|                          |               |                                     | A54100      | tumor suppressor protein DCC precursor                                                                                                    | 226  | 2.00e-58 |
|                          |               |                                     | CAA53735.1  | tumour suppressor                                                                                                                         | 226  | 2.00e-58 |
|                          |               |                                     | AAA35751.1  | colorectal tumor suppressor (put.); putative                                                                                              | 216  | 3.00e-55 |
| NM_013906<br>NP_038934.1 | Mm.1005<br>82 | U:(C-IR)<br>2.01<br>U:(C-D)<br>2.16 | Q9UP79      | ATS8_HUMAN ADAMTS-8 precursor (A disintegrin and metalloproteinase with thrombospondin motifs 8) (ADAM-TS 8) (ADAM-TS8) (METH-2) (METH-8) | 1404 | 0        |
|                          |               |                                     | AAD48081.1  | AF060153_1 METH2 protein                                                                                                                  | 1404 | 0        |
|                          |               |                                     | NP_008968.2 | a disintegrin and metalloprotease with thrombospondin motifs-8                                                                            | 1403 | 0        |
|                          |               |                                     | NP_008919.2 | a disintegrin and metalloprotease with thrombospondin motifs-1 preproprotein; human metalloproteinase with thrombospondin type 1 motifs   | 799  | 0        |
|                          |               |                                     | AAF23772.1  | AF207664_1 matrix metalloprotease                                                                                                         | 799  | 0        |
|                          |               |                                     | BAA95502.1  | metalloprotease with thrombospondin type 1 motifs                                                                                         | 799  | 0        |
|                          |               |                                     | AAD48080.1  | AF060152_1 METH1 protein                                                                                                                  | 798  | 0        |
|                          |               |                                     | Q9UHI8      | ATS1_HUMAN ADAMTS-1 precursor (A disintegrin and metalloproteinase with thrombospondin motifs 1) (ADAM-TS 1) (ADAM-TS1) (METH-1)          | 798  | 0        |

|             |         |          |  |             |                                                                                                             |      |          |
|-------------|---------|----------|--|-------------|-------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |          |  | AAF15317.1  | AF170084_1 metalloproteinase with thrombospondin type 1 motifs ADAMTS1                                      | 798  | 0        |
|             |         |          |  | BAA92584.1  | KIAA1346 protein                                                                                            | 798  | 0        |
|             |         |          |  | AAH36515.1  | Unknown (protein for MGC:32979)                                                                             | 795  | 0        |
|             |         |          |  | NP_620686.1 | a disintegrin-like and metalloprotease (repolyisin type) with thrombospondin type 1 motif, 15 preproprotein | 733  | 0        |
|             |         |          |  | CAC86014.1  | metalloprotease disintegrin 15 with thrombospondin domains                                                  | 733  | 0        |
| NM_013866   | Mm.1409 | U:(C-IR) |  | XP_028643.4 | similar to DKFZP586G1122 protein                                                                            | 543  | e-154    |
| NP_038894.1 | 9       | 2.01     |  | NP_056296.1 | DKFZP586G1122 protein                                                                                       | 543  | e-154    |
|             |         |          |  | AAL08625.1  | AF304052_1 hematopoietic zinc finger protein                                                                | 543  | e-154    |
|             |         |          |  | AAH29752.1  | DKFZP586G1122 protein                                                                                       | 543  | e-154    |
|             |         |          |  | T17248      | hypothetical protein DKFZp586G1122.1                                                                        | 426  | e-119    |
|             |         |          |  | CAB55938.1  | hypothetical protein                                                                                        | 426  | e-119    |
|             |         |          |  | BAB14910.1  | unnamed protein product                                                                                     | 321  | 3.00e-87 |
|             |         |          |  | NP_078973.1 | hypothetical protein FLJ22419                                                                               | 279  | 1.00e-74 |
|             |         |          |  | BAB15350.1  | unnamed protein product                                                                                     | 279  | 1.00e-74 |
|             |         |          |  | AAH07212.1  | AAH07212 hypothetical protein FLJ22419                                                                      | 279  | 1.00e-74 |
|             |         |          |  | BAC04870.1  | unnamed protein product                                                                                     | 266  | 1.00e-70 |
|             |         |          |  | NP_689733.1 | hypothetical protein FLJ25270                                                                               | 263  | 1.00e-69 |
|             |         |          |  | BAB71629.1  | unnamed protein product                                                                                     | 263  | 1.00e-69 |
|             |         |          |  | XP_087103.1 | similar to zinc finger protein 385; hematopoietic zinc finger                                               | 262  | 1.00e-69 |
|             |         |          |  | AAH38422.1  | hypothetical protein FLJ25270                                                                               | 262  | 1.00e-69 |
| NM_019762   | Mm.2960 | U:(C-IR) |  | NP_009114.1 | plakophilin 3                                                                                               | 1271 | 0        |
| NP_062736.1 | 3       | 2.01     |  | Q9Y446      | PKP3_HUMAN Plakophilin 3                                                                                    | 1271 | 0        |
|             |         |          |  | CAB44310.1  | plakophilin 3                                                                                               | 1271 | 0        |
|             |         |          |  | AAF23050.1  | AF053719_1 plakophilin-3 protein                                                                            | 1271 | 0        |

|             |          |          |  |             |                                                                                                                                                |      |          |
|-------------|----------|----------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |          |          |  | AAH00081.1  | AAH00081 plakophilin 3                                                                                                                         | 1271 | 0        |
|             |          |          |  | CAA66265.1  | plakophilin 2a                                                                                                                                 | 243  | 9.00e-64 |
|             |          |          |  | AAB97957.1  | arm-repeat protein NPRAP/neurojungin                                                                                                           | 237  | 6.00e-62 |
|             |          |          |  | AAD00453.1  | GT24                                                                                                                                           | 237  | 8.00e-62 |
|             |          |          |  | NP_001323.1 | catenin (cadherin-associated protein), delta 2 (neural plakophilin-related arm-repeat protein); catenin (cadherin-associated protein), delta 2 | 237  | 8.00e-62 |
|             |          |          |  | BAA36163.1  | neural plakophilin-related arm-repeat protein (NPRAP)                                                                                          | 237  | 8.00e-62 |
|             |          |          |  | Q9UQB3      | CTD2_HUMAN Catenin delta-2 (Delta-catenin) (Neural plakophilin-related ARM-repeat protein) (NPRAP) (Neurojungin) (GT24)                        | 232  | 3.00e-60 |
|             |          |          |  | AAC63103.1  | delta-catenin                                                                                                                                  | 232  | 3.00e-60 |
|             |          |          |  | S60712      | band-6-protein                                                                                                                                 | 228  | 4.00e-59 |
|             |          |          |  | CAA55881.1  | band-6-protein                                                                                                                                 | 228  | 4.00e-59 |
|             |          |          |  | NP_000290.1 | plakophilin 1; Plakophilin-1                                                                                                                   | 225  | 2.00e-58 |
|             |          |          |  | CAA84426.1  | plakophilin                                                                                                                                    | 225  | 2.00e-58 |
|             |          |          |  | CAA98022.1  | plakophilin 1                                                                                                                                  | 225  | 2.00e-58 |
|             |          |          |  | NP_004563.1 | plakophilin 2                                                                                                                                  | 222  | 2.00e-57 |
|             |          |          |  | Q99959      | PKP2_HUMAN Plakophilin 2                                                                                                                       | 222  | 2.00e-57 |
|             |          |          |  | CAA66264.1  | plakophilin 2b                                                                                                                                 | 222  | 2.00e-57 |
|             |          |          |  | NP_003619.1 | plakophilin 4                                                                                                                                  | 222  | 3.00e-57 |
|             |          |          |  | Q99569      | PKP4_HUMAN Plakophilin 4                                                                                                                       | 222  | 3.00e-57 |
|             |          |          |  | CAA57478.1  | p0071 protein                                                                                                                                  | 222  | 3.00e-57 |
| NM_028089   | Mm. 1425 | U:(C-IR) |  | NP_000763.1 | cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 18;                                                                    | 766  | 0        |
| NP_082365.1 | 81       | 2        |  |             | cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 17; microsomal monooxygenase; flavoprotein-linked monooxygenase        |      |          |
|             |          |          |  | AAB59356.1  | cytochrome                                                                                                                                     | 766  | 0        |
|             |          |          |  | P33260      | CPCI_HUMAN Cytochrome P450 2C18 (CYP11C18) (P450-6B/29C)                                                                                       | 764  | 0        |
|             |          |          |  | A61269      | cytochrome P450 2C18                                                                                                                           | 764  | 0        |
|             |          |          |  | AAA02630.1  | cytochrome P-4502C18                                                                                                                           | 764  | 0        |

|                          |               |                                      |  |             |                                                                                                                                                                                                                                             |     |          |
|--------------------------|---------------|--------------------------------------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |               |                                      |  | AAB23864.2  | cytochrome P-450                                                                                                                                                                                                                            | 736 | 0        |
|                          |               |                                      |  | NP_000762.2 | cytochrome P450, subfamily IIC, polypeptide 9; cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 10; mephenytoin 4-hydroxylase; microsomal monooxygenase; xenobiotic monooxygenase; flavoprotein-linked monooxygenase | 736 | 0        |
|                          |               |                                      |  | P11712      | CPC9_HUMAN Cytochrome P450 2C9 (CYPIIC9) (P450 PB-1) (P450 MP-4) (S-mephenytoin 4-hydroxylase) (P-450MP)                                                                                                                                    | 736 | 0        |
|                          |               |                                      |  | B38462      | S-mephenytoin 4-hydroxylase (EC 1.14.14.-) cytochrome P450 2C9                                                                                                                                                                              | 736 | 0        |
|                          |               |                                      |  | I313295A    | cytochrome P450                                                                                                                                                                                                                             | 736 | 0        |
|                          |               |                                      |  | BAA00123.1  | cytochrome P-450                                                                                                                                                                                                                            | 736 | 0        |
|                          |               |                                      |  | P11713      | CPCA_HUMAN Cytochrome P450 2C10 (CYPIIC10) (P450 MP-8) (S-mephenytoin 4-hydroxylase) (P-450MP)                                                                                                                                              | 729 | 0        |
|                          |               |                                      |  | D28951      | cytochrome P450 2C10                                                                                                                                                                                                                        | 729 | 0        |
|                          |               |                                      |  | AAA52157.1  | cytochrome P-450 S-mephenytoin 4-hydroxylase                                                                                                                                                                                                | 729 | 0        |
|                          |               |                                      |  | AAA52158.1  | cytochrome P-450 S-mephenytoin 4-hydroxylase                                                                                                                                                                                                | 729 | 0        |
|                          |               |                                      |  | 1506290A    | cytochrome P450                                                                                                                                                                                                                             | 728 | 0        |
|                          |               |                                      |  | NP_000760.1 | cytochrome P450, subfamily IIC (mephenytoin 4-hydroxylase), polypeptide 19; mephenytoin 4'-hydroxylase; microsomal monooxygenase; xenobiotic monooxygenase; flavoprotein-linked monooxygenase                                               | 726 | 0        |
|                          |               |                                      |  | P33261      | CPCJ_HUMAN Cytochrome P450 2C19 (CYPIIC19) (P450-11A) (Mephenytoin 4-hydroxylase) (CYPIIC17) (P450-254C)                                                                                                                                    | 726 | 0        |
|                          |               |                                      |  | AAB59426.1  | cytochrome                                                                                                                                                                                                                                  | 726 | 0        |
|                          |               |                                      |  | F38462      | S-mephenytoin 4'-hydroxylase (EC 1.14.14.-) cytochrome P450 2C19                                                                                                                                                                            | 722 | 0        |
| NM_010689<br>NP_034819.1 | Mm. 1028<br>0 | U:(C-IR)<br>13.11<br>U:(C-D)<br>2.17 |  | CAA11218.1  | 36 kDa phosphotyrosine protein                                                                                                                                                                                                              | 231 | 2.00e-60 |
|                          |               |                                      |  | AAC39636.1  | LAT                                                                                                                                                                                                                                         | 231 | 2.00e-60 |
|                          |               |                                      |  | AAH11563.1  | AAH11563 Similar to linker for activation of T cells                                                                                                                                                                                        | 231 | 2.00e-60 |

|             |         |                 |  |             |                                                                                                      |     |          |
|-------------|---------|-----------------|--|-------------|------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |                 |  | NP_055202.1 | linker for activation of T cells                                                                     | 215 | 1.00e-55 |
|             |         |                 |  | O43561      | LAT_HUMAN Linker for activation of T cells (36 kDa phospho-tyrosine adaptor protein) (pp36) (p36-38) | 215 | 1.00e-55 |
|             |         |                 |  | AAC39637.1  | LAT                                                                                                  | 215 | 1.00e-55 |
| NM_017370   | Mm.2673 | U:(C-D)<br>6.81 |  | CAA25926.1  | haptoglobin                                                                                          | 599 | e-171    |
| NP_059066.1 | 0       |                 |  | P00737      | HPT1_HUMAN Haptoglobin-1 precursor                                                                   | 598 | e-171    |
|             |         |                 |  | HPHU1       | haptoglobin precursor, allele 1 [validated]                                                          | 598 | e-171    |
|             |         |                 |  | AAA52684.1  | preprohaptoglobin                                                                                    | 598 | e-171    |
|             |         |                 |  | CAA25267.1  | haptoglobin alpha 1S                                                                                 | 598 | e-171    |
|             |         |                 |  | AAC27432.1  | haptoglobin                                                                                          | 597 | e-170    |
|             |         |                 |  | NP_066275.2 | haptoglobin-related protein; Haptoglobin-related locus                                               | 569 | e-162    |
|             |         |                 |  | P00739      | HPTR_HUMAN Haptoglobin-related protein precursor                                                     | 569 | e-162    |
|             |         |                 |  | HPHUR       | haptoglobin-related protein precursor                                                                | 569 | e-162    |
|             |         |                 |  | AAA88079.1  | haptoglobin-related protein                                                                          | 569 | e-162    |
|             |         |                 |  | AAA88081.1  | haptoglobin-related protein                                                                          | 569 | e-162    |
|             |         |                 |  | CAA25927.1  | haptoglobin                                                                                          | 568 | e-162    |
|             |         |                 |  | AAC27433.1  | haptoglobin-related protein precursor                                                                | 565 | e-161    |
|             |         |                 |  | CAA61501.1  | haptoglobin-related protein                                                                          | 565 | e-161    |
|             |         |                 |  | AAA52687.1  | haptoglobin precursor                                                                                | 559 | e-159    |
|             |         |                 |  | NP_005134.1 | haptoglobin                                                                                          | 559 | e-159    |
|             |         |                 |  | P00738      | HPT2_HUMAN Haptoglobin-2 precursor                                                                   | 559 | e-159    |
|             |         |                 |  | HPHU2       | haptoglobin precursor, allele 2                                                                      | 559 | e-159    |
|             |         |                 |  | CAA25137.1  | haptoglobin precursor                                                                                | 559 | e-159    |
|             |         |                 |  | AAA88078.1  | haptoglobin                                                                                          | 559 | e-159    |
|             |         |                 |  | AAA88080.1  | haptoglobin                                                                                          | 559 | e-159    |
|             |         |                 |  | AAA52685.1  | preprohaptoglobin                                                                                    | 559 | e-159    |

|             |         |                  |  |             |                                                                                                                                                                                 |  |      |       |
|-------------|---------|------------------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|
|             |         |                  |  | 1006264A    | haptoglobin Hp2                                                                                                                                                                 |  | 508  | e-144 |
| NM_007424   |         | U:(C-D)<br>4.11  |  |             | aggrecan 1 isoform 2 precursor; Aggrecan-1 (chondroitin sulfate proteoglycan-1, large aggregating proteoglycan, antigen identified by monoclonal antibody A0122);               |  |      |       |
| NP_031450.1 | Mm.2759 | U:(IR-D)<br>3.08 |  | NP_037359.1 | chondroitin sulfate proteoglycan 1, large aggregating proteoglycan                                                                                                              |  | 1795 | 0     |
|             |         |                  |  |             | aggrecan 1 isoform 1 precursor; Aggrecan-1 (chondroitin sulfate proteoglycan-1, large aggregating proteoglycan, antigen identified by monoclonal antibody A0122);               |  |      |       |
|             |         |                  |  | NP_001126.1 | chondroitin sulfate proteoglycan 1, large aggregating proteoglycan                                                                                                              |  | 1794 | 0     |
|             |         |                  |  | AAA62824.1  | large aggregating cartilage proteoglycan core protein                                                                                                                           |  | 1794 | 0     |
|             |         |                  |  | A39086      | aggrecan precursor, cartilage long splice form                                                                                                                                  |  | 1792 | 0     |
|             |         |                  |  |             | Similar to aggrecan 1 (chondroitin sulfate proteoglycan 1, large aggregating proteoglycan, antigen identified by monoclonal antibody A0122)                                     |  | 1253 | 0     |
|             |         |                  |  | AAH36445.1  |                                                                                                                                                                                 |  |      |       |
|             |         |                  |  | CAA35463.1  | cartilage specific proteoglycan (600 AA)                                                                                                                                        |  | 823  | 0     |
|             |         |                  |  | AAA35726.1  | proteoglycan core protein                                                                                                                                                       |  | 573  | e-162 |
|             |         |                  |  | AAH10571.1  | chondroitin sulfate proteoglycan BEHAB/brevican                                                                                                                                 |  | 369  | e-101 |
|             |         |                  |  | AAG23134.1  | AF228710_1 chondroitin sulfate proteoglycan BEHAB/brevican                                                                                                                      |  | 369  | e-101 |
|             |         |                  |  | AAG23135.1  | AF229053_1 chondroitin sulfate proteoglycan BEHAB/brevican                                                                                                                      |  | 369  | e-101 |
| NM_009008   |         |                  |  |             | ras-related C3 botulinum toxin substrate 2; Ras-related C3 botulinum toxin substrate 3 (rho family, small GTP-binding protein Rac2); rho family, small GTP binding protein Rac2 |  |      |       |
| NP_033034.1 | Mm.1972 | U:(C-D)<br>2.85  |  | NP_002863.1 |                                                                                                                                                                                 |  | 390  | e-108 |
|             |         |                  |  | P15153      | RAC2_HUMAN Ras-related C3 botulinum toxin substrate 2 (p21-Rac2) (Small G protein) (GX)                                                                                         |  | 390  | e-108 |
|             |         |                  |  | B34386      | GTP-binding protein rac2                                                                                                                                                        |  | 390  | e-108 |
|             |         |                  |  | IDS6        | A Chain A, Crystal Structure Of A Rac-Rhogdi Complex                                                                                                                            |  | 390  | e-108 |
|             |         |                  |  | AAA36538.1  | ras-related C3 botulinum toxin substrate                                                                                                                                        |  | 390  | e-108 |
|             |         |                  |  | AAB22207.1  | rac1 p21=small GTP-binding protein [human, HL60, Peptide, 192 aa]                                                                                                               |  | 390  | e-108 |
|             |         |                  |  |             | dJ151B14.2 (ras-related C3 botulinum toxin substrate 2 (rho family, mall GTP binding protein Rac2))                                                                             |  | 390  | e-108 |



|  |  |  |  |             |                                                                                                                                     |     |          |
|--|--|--|--|-------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  |  | AAH01485.1  | AAH01485 ras-related C3 botulinum toxin substrate 2 (rho family, small GTP binding protein Rac2)                                    | 390 | e-108    |
|  |  |  |  | AAM21112.1  | AF498965_1 small GTP binding protein RAC2                                                                                           | 390 | e-108    |
|  |  |  |  | NP_008839.2 | ras-related C3 botulinum toxin substrate 1 isoform Rac1; rho family, small GTP binding protein Rac1                                 | 367 | e-101    |
|  |  |  |  | P15154      | RAC1_HUMAN Ras-related C3 botulinum toxin substrate 1 (p21-Rac1) (Ras-like protein TC25)                                            | 367 | e-101    |
|  |  |  |  | TVHUC1      | GTP-binding protein rac1                                                                                                            | 367 | e-101    |
|  |  |  |  | 1I4D        | D Chain D, Crystal Structure Analysis Of Rac1-Gdp Complexed With Arfaptin (P21)                                                     | 367 | e-101    |
|  |  |  |  | 1I4L        | D Chain D, Crystal Structure Analysis Of Rac1-Gdp In Complex With Arfaptin (P41)                                                    | 367 | e-101    |
|  |  |  |  | AAA36537.1  | ras-related C3 botulinum toxin substrate                                                                                            | 367 | e-101    |
|  |  |  |  | AAB22206.1  | rac1_p21=small GTP-binding protein [human, HL60, Peptide, 192 aa]                                                                   | 367 | e-101    |
|  |  |  |  | CAB53579.5  | Rac1 protein                                                                                                                        | 367 | e-101    |
|  |  |  |  | AAM21111.1  | AF498964_1 small GTP binding protein RAC1                                                                                           | 367 | e-101    |
|  |  |  |  | AAH04247.1  | AAH04247 ras-related C3 botulinum toxin substrate 1 (rho family, small GTP binding protein Rac1)                                    | 367 | e-101    |
|  |  |  |  | AAA35941.1  | small G protein                                                                                                                     | 366 | e-101    |
|  |  |  |  | AAA36544.1  | ras-like protein                                                                                                                    | 366 | e-101    |
|  |  |  |  | 1I4T        | D Chain D, Crystal Structure Analysis Of Rac1-Gmppnp In Complex With Arfaptin                                                       | 365 | e-100    |
|  |  |  |  | 1.00e+96    | A Chain A, Structure Of The RacP67PHOX COMPLEX                                                                                      | 363 | e-100    |
|  |  |  |  | 1HH4        | A Chain A, Rac1-Rhogdi Complex Involved In NADPH Oxidase Activation                                                                 | 362 | e-100    |
|  |  |  |  | 1HH4        | B Chain B, Rac1-Rhogdi Complex Involved In NADPH Oxidase Activation                                                                 | 362 | e-100    |
|  |  |  |  | NP_005043.1 | ras-related C3 botulinum toxin substrate 3 (rho family, small GTP binding protein Rac3); rho family, small GTP binding protein Rac3 | 358 | 1.00e-98 |
|  |  |  |  | O14658      | RAC3_HUMAN Ras-related C3 botulinum toxin substrate 3 (p21-Rac3)                                                                    | 358 | 1.00e-98 |
|  |  |  |  | AAC51667.1  | Rac3                                                                                                                                | 358 | 1.00e-98 |
|  |  |  |  | AAH15197.1  | AAH15197 ras-related C3 botulinum toxin substrate 3 (rho family, small GTP binding protein Rac3)                                    | 358 | 1.00e-98 |

|            |          |                 |  |             |                                                                                                                                                                                                     |     |          |
|------------|----------|-----------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|            |          |                 |  | AAH09605.1  | AAH09605 ras-related C3 botulinum toxin substrate 3 (rho family, small GTP binding protein Rac3)                                                                                                    | 358 | 1.00e-98 |
|            |          |                 |  | AAM21113.1  | AF498966_1 small GTP binding protein RAC3                                                                                                                                                           | 358 | 1.00e-98 |
|            |          |                 |  | NP_061485.1 | ras-related C3 botulinum toxin substrate 1 isoform Rac1b; rho family, small GTP binding protein Rac1                                                                                                | 356 | 5.00e-98 |
|            |          |                 |  | CAA10732.1  | small GTPase rac1b                                                                                                                                                                                  | 356 | 5.00e-98 |
|            |          |                 |  | AAD30547.1  | AF136373_1 ras-related C3 botulinum toxin substrate isoform                                                                                                                                         | 356 | 5.00e-98 |
|            |          |                 |  | CAA10733.6  | Rac1b protein                                                                                                                                                                                       | 356 | 5.00e-98 |
| AK013740   |          |                 |  |             |                                                                                                                                                                                                     |     |          |
| BAB28979.1 | Mm.27579 | U:(C-D)<br>2.82 |  | NP_068747.1 | hypothetical protein FLJ22649 similar to signal peptidase SPC22/23                                                                                                                                  | 298 | 1.00e-80 |
|            |          |                 |  | BAB15437.1  | unnamed protein product                                                                                                                                                                             | 298 | 1.00e-80 |
|            |          |                 |  | Q9H0S7      | SP22_HUMAN Microsomal signal peptidase 23 kDa subunit (SPase 22 kDa subunit)                                                                                                                        | 295 | 9.00e-80 |
|            |          |                 |  | CAB66595.1  | hypothetical protein                                                                                                                                                                                | 295 | 9.00e-80 |
| X00496     |          | U:(C-D)<br>2.81 |  | NP_004346.1 | CD74 antigen (invariant polypeptide of major histocompatibility complex, class II antigen-associated); CD74 antigen (invariant polypeptide of major histocompatibility class II antigen-associated) | 226 | 4.00e-59 |
| CAA25191.1 | Mm.7043  |                 |  |             |                                                                                                                                                                                                     |     |          |
|            |          |                 |  | CAA25192.1  | putative p33                                                                                                                                                                                        | 226 | 4.00e-59 |
|            |          |                 |  | AAA36033.1  | cell surface glycoprotein                                                                                                                                                                           | 226 | 4.00e-59 |
|            |          |                 |  | AAH18726.1  | AAH18726 CD74 antigen (invariant polypeptide of major histocompatibility complex, class II antigen-associated)                                                                                      | 226 | 4.00e-59 |
|            |          |                 |  | HLHUG       | class II histocompatibility antigen-associated gamma chain                                                                                                                                          | 226 | 4.00e-59 |
|            |          |                 |  | CAA25193.1  | putative p33                                                                                                                                                                                        | 226 | 4.00e-59 |
|            |          |                 |  | AAA36304.1  | class II antigen gamma chain                                                                                                                                                                        | 226 | 4.00e-59 |
|            |          |                 |  | CAA27047.1  | gamma chain                                                                                                                                                                                         | 225 | 9.00e-59 |
|            |          |                 |  | P04233      | HG2A_HUMAN HLA class II histocompatibility antigen, gamma chain (HLA-DR antigens associated invariant chain) (Ia antigen-associated invariant chain) (Ii) (p33) (CD74 antigen)                      | 207 | 1.00e-53 |

|                          |              |                                    |             |                                                                                                                                                                                                                                                                                |      |       |
|--------------------------|--------------|------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
| NM_015737<br>NP_056552.1 | Mm.5699<br>1 | U:(C-D)<br>2.72<br>U:(IR-D)<br>2.1 | AAH36390.1  | UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 4 (GalNAc-T4)                                                                                                                                                                                  | 1078 | 0     |
|                          |              |                                    | NP_003765.1 | polypeptide N-acetylglactosaminyltransferase 4;<br>UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 4; GalNAc transferase 4; UDP-GalNAc: polypeptide N-acetylglactosaminyltransferase 4; protein-UDP acetylglactosaminyltransferase 4           | 1073 | 0     |
|                          |              |                                    | CAA69875.1  | UDP-GalNAc:polypeptide N-acetylglactosaminyltransferase                                                                                                                                                                                                                        | 1073 | 0     |
|                          |              |                                    | CAC80100.2  | UDP-GalNAc-transferase 12                                                                                                                                                                                                                                                      | 624  | e-178 |
|                          |              |                                    | NP_078918.2 | hypothetical protein FLJ21212; UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 12(GalNAc-T12)                                                                                                                                                  | 622  | e-178 |
|                          |              |                                    | BAC07181.1  | UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 12                                                                                                                                                                                             | 622  | e-178 |
|                          |              |                                    | NP_004473.1 | polypeptide N-acetylglactosaminyltransferase 3; protein-UDP acetylglactosaminyltransferase                                                                                                                                                                                     | 462  | e-130 |
|                          |              |                                    | CAA63371.1  | UDP-GalNAc:polypeptide N-acetylglactosaminyltransferase (GalNAc-T3)                                                                                                                                                                                                            | 462  | e-130 |
|                          |              |                                    | AAH35822.1  | UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 6 (GalNAc-T6)                                                                                                                                                                                  | 461  | e-129 |
|                          |              |                                    | BAC11118.1  | unnamed protein product                                                                                                                                                                                                                                                        | 461  | e-129 |
|                          |              |                                    | NP_009141.1 | polypeptide N-acetylglactosaminyltransferase 6;<br>UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 6; UDP-GalNAc:polypeptide N-acetylglactosaminyltransferase 6; protein-UDP acetylglactosaminyltransferase 6; GalNAc transferase 6            | 459  | e-129 |
|                          |              |                                    | CAA69876.1  | UDP-GalNAc:polypeptide N-acetylglactosaminyltransferase                                                                                                                                                                                                                        | 459  | e-129 |
|                          |              |                                    | BAB67811.1  | KIAA1918 protein                                                                                                                                                                                                                                                               | 417  | e-116 |
|                          |              |                                    | NP_065207.2 | polypeptide N-acetylglactosaminyltransferase 1;<br>UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglactosaminyltransferase 1; GalNAc-T1; GalNAc transferase 1; protein-UDP acetylglactosaminyltransferase 1; UDP-GalNAc:polypeptide N-acetylglactosaminyltransferase 1 | 416  | e-116 |

|                            |          |                 |  |             |                                                                                                                                                                          |     |       |
|----------------------------|----------|-----------------|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|                            |          |                 |  | Q10472      | PAGT_HUMAN Polypeptide N-acetylglucosaminyltransferase (Protein-UDP acetylglucosaminyltransferase) (UDP-GalNAc:polypeptide, N-acetylglucosaminyltransferase) (GalNAc-T1) | 416 | e-116 |
|                            |          |                 |  | JC4223      | polypeptide N-acetylglucosaminyltransferase (EC 2.4.1.41)                                                                                                                | 416 | e-116 |
|                            |          |                 |  | CAA59380.1  | UDP-GalNAc:polypeptide N-acetylglucosaminyl transferase                                                                                                                  | 416 | e-116 |
| NM_018866<br>NP_061354.1 6 | Mm.1011  | U:(C-D)<br>2.65 |  |             |                                                                                                                                                                          |     |       |
| NM_008458                  |          |                 |  |             |                                                                                                                                                                          |     |       |
| NP_032484.1                | Mm.14191 | U:(C-D)<br>2.59 |  | CAA48671.1  | alpha1-antichymotrypsin                                                                                                                                                  | 494 | e-139 |
|                            |          |                 |  | XP_028322.1 | similar to Alpha-1-antichymotrypsin precursor (ACT)                                                                                                                      | 490 | e-138 |
|                            |          |                 |  | P01011      | AACT_HUMAN Alpha-1-antichymotrypsin precursor (ACT)                                                                                                                      | 490 | e-138 |
|                            |          |                 |  | AAH03559.1  | serine (or cysteine) proteinase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 3                                                                       | 490 | e-138 |
|                            |          |                 |  | AAH10530.1  | Unknown (protein for MGC:18102)                                                                                                                                          | 490 | e-138 |
|                            |          |                 |  | AAH34554.1  | serine (or cysteine) proteinase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 3                                                                       | 489 | e-138 |
|                            |          |                 |  | AAD08810.1  | alpha-1-antichymotrypsin precursor                                                                                                                                       | 478 | e-134 |
|                            |          |                 |  | ITHUC       | alpha-1-antichymotrypsin precursor                                                                                                                                       | 476 | e-134 |
|                            |          |                 |  | AAA51560.1  | alpha-1-antichymotrypsin precursor                                                                                                                                       | 470 | e-132 |
|                            |          |                 |  | IQMN        | A Chain A, Alpha1-Antichymotrypsin Serpin In The Delta Conformation (Partial Loop Insertion)                                                                             | 460 | e-129 |
|                            |          |                 |  | 1313184C    | chymotrypsin inhibitor                                                                                                                                                   | 441 | e-123 |
|                            |          |                 |  | NP_001076.1 | alpha-1-antichymotrypsin, precursor; alpha-1-antichymotrypsin; antichymotrypsin                                                                                          | 439 | e-123 |
|                            |          |                 |  | AAA51543.1  | alpha-1-antichymotrypsin                                                                                                                                                 | 439 | e-123 |
|                            |          |                 |  | 2ACH        | A Chain A, Alpha1 Antichymotrypsin                                                                                                                                       | 434 | e-121 |
| NM_010382<br>NP_034512.1 4 | Mm.2256  | U:(C-D)<br>2.59 |  | AAH07920.1  | AAH07920 Unknown (protein for MGC:14111)                                                                                                                                 | 390 | e-108 |

|             |  |  |                             |             |                                                                                                 |     |          |
|-------------|--|--|-----------------------------|-------------|-------------------------------------------------------------------------------------------------|-----|----------|
|             |  |  |                             | AAL40069.1  | L76133_1 lymphocyte antigen                                                                     | 390 | e-108    |
|             |  |  |                             | AAH08403.1  | AAH08403 Similar to major histocompatibility complex, class II, DR beta 5                       | 387 | e-107    |
|             |  |  |                             | CAC08827.1  | MHC class II antigen                                                                            | 386 | e-107    |
|             |  |  |                             | I54448      | MHC class II histocompatibility antigen DR beta 1 chain precursor                               | 386 | e-107    |
|             |  |  |                             | AAA59713.1  | precursor                                                                                       | 386 | e-107    |
|             |  |  |                             | CAC08823.1  | MHC class II antigen                                                                            | 386 | e-107    |
|             |  |  |                             | P20039      | HB2I_HUMAN HLA class II histocompatibility antigen, DR-5 beta chain precursor                   | 385 | e-107    |
|             |  |  |                             | A25324      | class II histocompatibility antigen HLA-DR-5 beta chain precursor                               | 385 | e-107    |
|             |  |  |                             | AAA36274.1  | MHC HLA DR5 cell surface glycoprotein beta chain precursor                                      | 385 | e-107    |
|             |  |  |                             | CAC08826.2  | MHC class II antigen                                                                            | 385 | e-107    |
|             |  |  |                             | P13760      | HB2H_HUMAN HLA class II histocompatibility antigen, DR-4 beta chain precursor (DRB1*0401)       | 385 | e-107    |
|             |  |  |                             | A29310      | MHC class II histocompatibility antigen HLA-DR beta 1 chain DR4 precursor                       | 385 | e-107    |
|             |  |  |                             | CAC19360.1  | dJ863G3.2 (major histocompatibility complex, class II, DR beta 1)                               | 385 | e-107    |
|             |  |  |                             | CAB75359.1  | human leucocyte antigen DRB1                                                                    | 385 | e-107    |
|             |  |  |                             | P01912      | HB2B_HUMAN HLA class II histocompatibility antigen, DR-1 beta chain precursor (Clone P2-beta-3) | 385 | e-107    |
|             |  |  |                             |             | pit  HLHU3D MHC class II histocompatibility antigen HLA-DR beta 1 chain DR17 precursor          | 385 | e-107    |
|             |  |  |                             | CAA25295.1  | precursor                                                                                       | 385 | e-107    |
|             |  |  |                             | CAB06490.1  | dJ93N13.3 (major histocompatibility complex, class II, DR beta 1 (clone P2-beta-3))             | 385 | e-107    |
| AK012581    |  |  |                             |             |                                                                                                 |     |          |
| XP_126675.1 |  |  | U:(C-D)<br>Mm.21687<br>2.55 | AAK67634.1  | hypothetical protein SB143                                                                      | 240 | 2.00e-63 |
|             |  |  |                             | NP_085053.1 | hypothetical protein MGC10986                                                                   | 240 | 2.00e-63 |
|             |  |  |                             | AAH04400.1  | Unknown (protein for MGC:10986)                                                                 | 240 | 2.00e-63 |

|             |         |                 |             |                                                                                                                                                                                                                                               |  |     |          |
|-------------|---------|-----------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |                 | BAC03855.1  | unnamed protein product                                                                                                                                                                                                                       |  | 240 | 2.00e-63 |
| NM_027209   | Mm.2948 | U:(C-D)<br>2.47 | NP_690591.1 | membrane-spanning 4-domains, subfamily A, member 6A isoform 1; CD20-like precursor; membrane-spanning 4-domains, subfamily A, member 6; four-span transmembrane protein 3.2; MS4A6A-polymorph; four-span transmembrane protein 3.1; HAIRB-iso |  | 233 | 5.00e-61 |
| NP_081485.1 | 7       |                 | AAG41780.1  | AF212240_1 CDA01                                                                                                                                                                                                                              |  | 233 | 5.00e-61 |
|             |         |                 | AAK37417.1  | AF237908_1 MS4A6A protein                                                                                                                                                                                                                     |  | 233 | 5.00e-61 |
|             |         |                 | AAK37994.1  | AF286866_1 MS4A6A-polymorph                                                                                                                                                                                                                   |  | 233 | 5.00e-61 |
|             |         |                 | AAH22854.1  | membrane-spanning 4-domains, subfamily A, member 6A                                                                                                                                                                                           |  | 232 | 8.00e-61 |
|             |         |                 | AAL56222.1  | AF350502_1 four-span transmembrane protein 3.1                                                                                                                                                                                                |  | 229 | 5.00e-60 |
|             |         |                 | AAG44626.1  | AF253977_1 HAIRB-iso                                                                                                                                                                                                                          |  | 222 | 1.00e-57 |
|             |         |                 | NP_071744.2 | membrane-spanning 4-domains, subfamily A, member 6A isoform 2; CD20-like precursor; membrane-spanning 4-domains, subfamily A, member 6; four-span transmembrane protein 3.2; MS4A6A-polymorph; four-span transmembrane protein 3.1; HAIRB-iso |  | 208 | 1.00e-53 |
|             |         |                 | AAL07357.1  | AF354930_1 MS4A6A                                                                                                                                                                                                                             |  | 208 | 1.00e-53 |
|             |         |                 | AAG27920.1  | AF142409_1 CD20-like precursor                                                                                                                                                                                                                |  | 207 | 2.00e-53 |
|             |         |                 | AAL56223.1  | AF350503_1 four-span transmembrane protein 3.2                                                                                                                                                                                                |  | 207 | 4.00e-53 |
| NM_011116   | Mm.6483 | U:(C-D)<br>2.45 | AAH36327.1  | Similar to phospholipase D3                                                                                                                                                                                                                   |  | 890 | 0        |
| NP_035246.1 |         |                 | AAH00553.1  | AAH00553 similar to vaccinia virus HindIII K4L ORF                                                                                                                                                                                            |  | 818 | 0        |
|             |         |                 | NP_036400.1 | similar to vaccinia virus HindIII K4L ORF                                                                                                                                                                                                     |  | 816 | 0        |
|             |         |                 | AAB16799.1  | HU-K4                                                                                                                                                                                                                                         |  | 816 | 0        |
|             |         |                 | NP_620145.1 | hypothetical protein BC015003                                                                                                                                                                                                                 |  | 385 | e-106    |
|             |         |                 | AAH15003.1  | AAH15003 Unknown (protein for MGC:23565)                                                                                                                                                                                                      |  | 385 | e-106    |
|             |         |                 | NP_689879.1 | hypothetical protein FLJ40773                                                                                                                                                                                                                 |  | 275 | 2.00e-73 |
|             |         |                 | BAC05230.1  | unnamed protein product                                                                                                                                                                                                                       |  | 275 | 2.00e-73 |
|             |         |                 | BAC03722.1  | unnamed protein product                                                                                                                                                                                                                       |  | 223 | 9.00e-58 |

|                          |               |                 |             |                                                                                                   |      |          |
|--------------------------|---------------|-----------------|-------------|---------------------------------------------------------------------------------------------------|------|----------|
| NM_013487<br>NP_038515.1 | Mm.4527       | U:(C-D)<br>2.39 | NP_000723.1 | CD3D antigen, delta polypeptide (TtT3 complex)                                                    | 228  | 5.00e-60 |
|                          |               |                 | P04234      | CD3D_HUMAN T-cell surface glycoprotein CD3 delta chain precursor (T-cell receptor T3 delta chain) | 228  | 5.00e-60 |
|                          |               |                 | RWHUD1      | T-cell surface glycoprotein CD3 delta chain precursor                                             | 228  | 5.00e-60 |
|                          |               |                 | CAA25683.1  | 20K T3 glycoprotein precursor                                                                     | 228  | 5.00e-60 |
|                          |               |                 | AAA51792.1  | T3 antigen delta-chain                                                                            | 228  | 5.00e-60 |
|                          |               |                 | CAA27573.1  | T3 delta protein                                                                                  | 228  | 5.00e-60 |
|                          |               |                 | 1101394A    | protein delta T3.glyco                                                                            | 222  | 2.00e-58 |
| AK004773                 |               |                 |             |                                                                                                   |      |          |
| XP_125911.2              | Mm.32580      | U:(C-D)<br>2.27 | NP_055686.1 | KIAA0710 gene product                                                                             | 1150 | 0        |
|                          |               |                 | BAA31685.1  | KIAA0710 protein                                                                                  | 1150 | 0        |
|                          |               |                 | AAH24043.1  | KIAA0710 gene product                                                                             | 1141 | 0        |
| NM_007804                |               |                 |             |                                                                                                   |      |          |
| NP_031830.1              | Mm.5116       | U:(C-D)<br>2.26 | O14529      | CUT2_HUMAN Homeobox protein Cux-2 (Cut-like 2)                                                    | 1950 | 0        |
|                          |               |                 | BAA22962.2  | The human homolog of mouse Cux-2                                                                  | 1950 | 0        |
|                          |               |                 | XP_027045.6 | similar to Homeobox protein Cux-2 (Cut-like 2)                                                    | 1949 | 0        |
|                          |               |                 | P39880      | CUT1_HUMAN CCAAT displacement protein (CDP) (Cut-like 1)                                          | 892  | 0        |
|                          |               |                 | AAB26579.1  | CCAAT displacement protein, CDP [human, Peptide, 1505 aa]                                         | 892  | 0        |
|                          |               |                 | NP_001904.1 | cut-like 1, CCAAT displacement protein (Drosophila)                                               | 283  | 2.00e-75 |
|                          |               |                 | AAA35654.1  | alternatively spliced                                                                             | 283  | 2.00e-75 |
|                          |               |                 | AAH25422.1  | cut-like 1, CCAAT displacement protein (Drosophila)                                               | 283  | 2.00e-75 |
|                          |               |                 | AAG59620.1  | AF271236_1 transcription factor CUX2                                                              | 238  | 8.00e-62 |
| NM_026384<br>NP_080660.1 | Mm.1801<br>89 | U:(C-D)<br>2.26 | CAD38961.1  | hypothetical protein                                                                              | 761  | 0        |
|                          |               |                 | NP_115953.2 | diacylglycerol O-acyltransferase homolog 2; GS1999full                                            | 751  | 0        |

|             |          |                 |  |             |                                                                                                    |      |          |
|-------------|----------|-----------------|--|-------------|----------------------------------------------------------------------------------------------------|------|----------|
|             |          |                 |  | AAH15234.1  | AAH15234 Unknown (protein for MGC:17861)                                                           | 751  | 0        |
|             |          |                 |  | AAK84176.2  | AF384161_1 diacylglycerol acyltransferase 2                                                        | 751  | 0        |
|             |          |                 |  | BAB40641.2  | product is unknown                                                                                 | 751  | 0        |
|             |          |                 |  | CAD13492.1  | bA351K23.5 (novel protein)                                                                         | 340  | 2.00e-93 |
|             |          |                 |  | NP_477513.1 | diacylglycerol O-acyltransferase 2 like 1; diacylglycerol acyltransferase 2-like                   | 331  | 1.00e-90 |
|             |          |                 |  | AAK84178.1  | AF384163_1 diacylglycerol acyltransferase 2-like protein                                           | 331  | 1.00e-90 |
|             |          |                 |  | AAD45832.1  | AC004876_5 similar to predicted proteins AAB54240 (PID:g2088822) and S67138 (PID:g2132925)         | 295  | 1.00e-79 |
|             |          |                 |  | XP_088691.1 | similar to bA351K23.5 (novel protein)                                                              | 251  | 1.00e-66 |
|             |          |                 |  | XP_088683.1 | similar to bA351K23.5 (novel protein)                                                              | 219  | 5.00e-57 |
|             |          |                 |  | XP_093119.2 | similar to bA351K23.5 (novel protein)                                                              | 215  | 1.00e-55 |
|             |          |                 |  | NP_079374.1 | hypothetical protein FLJ22644                                                                      | 206  | 5.00e-53 |
|             |          |                 |  | BAB15436.1  | unnamed protein product                                                                            | 206  | 5.00e-53 |
| AK004809    |          |                 |  |             |                                                                                                    |      |          |
| BAB23580.1  | Mm.28152 | U:(C-D)<br>2.25 |  | AAN41656.1  | ezrin-binding protein PACE-1                                                                       | 1081 | 0        |
|             |          |                 |  | CAB55300.1  | hypothetical protein                                                                               | 956  | 0        |
|             |          |                 |  | CAB52564.2  | dI97P20.1 (novel gene)                                                                             | 956  | 0        |
|             |          |                 |  | AAN23123.1  | ezrin-binding partner PACE-1                                                                       | 956  | 0        |
|             |          |                 |  | NP_065156.4 | ezrin-binding partner PACE-1                                                                       | 954  | 0        |
|             |          |                 |  | AAH14662.1  | Similar to hypothetical protein LOC57147                                                           | 954  | 0        |
| NM_009151   |          |                 |  |             |                                                                                                    |      |          |
| NP_033177.1 | Mm.22173 | U:(C-D)<br>2.25 |  | XP_006867.4 | similar to P-selectin glycoprotein ligand 1 precursor (PSGL-1) (Selectin P ligand) (CD162 antigen) | 286  | 5.00e-77 |
|             |          |                 |  | Q14242      | SEPL HUMAN P-selectin glycoprotein ligand 1 precursor (PSGL-1) (Selectin P ligand) (CD162 antigen) | 286  | 5.00e-77 |
|             |          |                 |  | A57468      | P-selectin glycoprotein ligand PSGL-1 precursor, long splice form                                  | 286  | 5.00e-77 |
|             |          |                 |  | AAA74577.1  | P-selectin glycoprotein ligand                                                                     | 286  | 5.00e-77 |



|                          |               |                 |             |                                                                                                          |  |     |          |
|--------------------------|---------------|-----------------|-------------|----------------------------------------------------------------------------------------------------------|--|-----|----------|
|                          |               |                 | NP_002997.1 | selectin P ligand                                                                                        |  | 284 | 2.00e-76 |
|                          |               |                 | AAC50061.1  | ligand for P-selectin                                                                                    |  | 284 | 2.00e-76 |
|                          |               |                 | AAH29782.1  | selectin P ligand                                                                                        |  | 284 | 2.00e-76 |
|                          |               |                 | BAC05283.1  | unnamed protein product                                                                                  |  | 258 | 2.00e-68 |
| NM_030255<br>NP_084531.1 | Mm.8970<br>2  | U:(C-D)<br>2.24 | NP_660341.2 | apolipoprotein B mRNA editing enzyme, catalytic polypeptide-like 3F; similar to Phorbol 3 (APOBEC1-like) |  | 200 | 7.00e-51 |
|                          |               |                 | AAH38808.1  | apolipoprotein B mRNA editing enzyme, catalytic polypeptide-like 3F                                      |  | 199 | 1.00e-50 |
| AK009960                 |               |                 |             |                                                                                                          |  |     |          |
| XP_133997.2              | Mm.28248      | U:(C-D)<br>2.23 | BAA96067.1  | KIAA1543 protein                                                                                         |  | 388 | e-108    |
|                          |               |                 | XP_048362.1 | similar to KIAA1543 protein                                                                              |  | 388 | e-108    |
|                          |               |                 | CAD38783.1  | hypothetical protein                                                                                     |  | 388 | e-108    |
|                          |               |                 | AAL55764.1  | AF289580_1 unknown                                                                                       |  | 320 | 1.00e-87 |
|                          |               |                 | XP_036589.2 | similar to KIAA1078 protein                                                                              |  | 237 | 2.00e-62 |
|                          |               |                 | AAH11385.1  | Unknown (protein for IMAGE:3870900)                                                                      |  | 237 | 2.00e-62 |
|                          |               |                 | BAA83030.2  | KIAA1078 protein                                                                                         |  | 237 | 2.00e-62 |
|                          |               |                 | T14744      | hypothetical protein DKFZp586F0424.1                                                                     |  | 236 | 3.00e-62 |
|                          |               |                 | CAB53664.1  | hypothetical protein                                                                                     |  | 236 | 3.00e-62 |
|                          |               |                 | AAH12778.1  | Unknown (protein for IMAGE:3939659)                                                                      |  | 227 | 1.00e-59 |
|                          |               |                 | CAD39184.1  | hypothetical protein                                                                                     |  | 227 | 1.00e-59 |
| NM_024249<br>NP_077211.2 | Mm.3310       | U:(C-D)<br>2.23 | NP_612637.1 | hypothetical protein MGC15523                                                                            |  | 689 | 0        |
|                          |               |                 | AAH14642.1  | AAH14642 Similar to RIKEN cDNA 1810073N04 gene                                                           |  | 689 | 0        |
|                          |               |                 | BAC04027.1  | unnamed protein product                                                                                  |  | 275 | 1.00e-73 |
| NM_030562<br>NP_085039.1 | Mm.1832<br>64 | U:(C-D)<br>2.21 | BAA96008.1  | KIAA1484 protein                                                                                         |  | 701 | 0        |
|                          |               |                 | XP_046088.1 | similar to hypothetical protein MGC7599; clone MGC:7599                                                  |  | 670 | 0        |
|                          |               |                 | XP_085176.1 | similar to hypothetical protein MGC2656                                                                  |  | 484 | e-136    |

|             |         |              |  |             |                                                                                                                       |      |          |
|-------------|---------|--------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |              |  | NP_689660.1 | hypothetical protein FLJ30803                                                                                         | 484  | e-136    |
|             |         |              |  | BAB70910.1  | unnamed protein product                                                                                               | 484  | e-136    |
|             |         |              |  | BAA86560.1  | KIAA1246 protein                                                                                                      | 466  | e-131    |
|             |         |              |  | XP_166372.1 | similar to hypothetical protein MGC2656                                                                               | 466  | e-131    |
|             |         |              |  | NP_078785.1 | hypothetical protein MGC2656                                                                                          | 446  | e-125    |
|             |         |              |  | AAH03578.1  | AAH03578 Unknown (protein for MGC:2656)                                                                               | 446  | e-125    |
|             |         |              |  | AAH25310.1  | Similar to KIAA1484 protein                                                                                           | 431  | e-120    |
|             |         |              |  | NP_076941.2 | hypothetical protein MGC3103                                                                                          | 424  | e-118    |
|             |         |              |  | AAH15581.2  | similar to hypothetical protein MGC3103                                                                               | 424  | e-118    |
|             |         |              |  | AAH14678.1  | AAH14678 Unknown (protein for IMAGE:3860672)                                                                          | 274  | 2.00e-73 |
| NM_033614   | Mm.1969 |              |  | JC4520      | 3',5'-cyclic-GMP phosphodiesterase (EC 3.1.4.35) alpha' chain                                                         | 1489 | 0        |
| NP_291092.1 | 71      | U:(C-D) 2.15 |  | CAA64079.1  | cone cGMP phosphodiesterase                                                                                           | 1489 | 0        |
|             |         |              |  | 2207224A    | cGMP phosphodiesterase                                                                                                | 1489 | 0        |
|             |         |              |  | P51160      | CNRC_HUMAN Cone cGMP-specific 3',5'-cyclic phosphodiesterase alpha'-subunit                                           | 1484 | 0        |
|             |         |              |  | AAA92886.1  | cone photoreceptor cGMP-phosphodiesterase alpha' subunit                                                              | 1484 | 0        |
|             |         |              |  | NP_006195.2 | phosphodiesterase 6C, cGMP-specific, cone, alpha prime                                                                | 1478 | 0        |
|             |         |              |  | AAA96392.1  | phosphodiesterase A' subunit                                                                                          | 1478 | 0        |
|             |         |              |  | NP_000274.1 | phosphodiesterase 6B, cGMP-specific, rod, beta                                                                        | 1092 | 0        |
|             |         |              |  | P35913      | CNRB_HUMAN Rod cGMP-specific 3',5'-cyclic phosphodiesterase beta-subunit (GMP-PDE beta)                               | 1092 | 0        |
|             |         |              |  | A42828      | 3',5'-cyclic-GMP phosphodiesterase (EC 3.1.4.35) beta chain                                                           | 1092 | 0        |
|             |         |              |  | AAB22690.1  | rod cGMP phosphodiesterase beta-subunit; PDEB                                                                         | 1092 | 0        |
|             |         |              |  | CAA46932.1  | 3',5'-cyclic-nucleotide phosphodiesterase                                                                             | 1092 | 0        |
|             |         |              |  | AAH00249.1  | AAH00249 phosphodiesterase 6B, cGMP-specific, rod, beta (congenital stationary night blindness 3, autosomal dominant) | 1089 | 0        |
|             |         |              |  | CAA44569.1  | cGMP phosphodiesterase beta subunit                                                                                   | 1085 | 0        |

|                          |              |                 |  |             |                                                                                                            |      |       |
|--------------------------|--------------|-----------------|--|-------------|------------------------------------------------------------------------------------------------------------|------|-------|
|                          |              |                 |  | B34611      | 3',5'-cyclic-GMP phosphodiesterase (EC 3.1.4.35) alpha chain                                               | 1075 | 0     |
|                          |              |                 |  | NP_000431.1 | phosphodiesterase 6A, alpha subunit                                                                        | 1074 | 0     |
|                          |              |                 |  | P16499      | CNRA_HUMAN Rod cGMP-specific 3',5'-cyclic phosphodiesterase alpha-subunit (GMP-PDE alpha) (PDE V-B1)       | 1074 | 0     |
|                          |              |                 |  | AAB69155.1  | cGMP phosphodiesterase                                                                                     | 1074 | 0     |
|                          |              |                 |  | CAA62215.1  | Rod cGMP phosphodiesterase                                                                                 | 893  | 0     |
|                          |              |                 |  | NP_058649.2 | phosphodiesterase 11A; cyclic nucleotide phosphodiesterase 11A1                                            | 409  | e-113 |
|                          |              |                 |  | BAB16371.1  | phosphodiesterase 11A                                                                                      | 409  | e-113 |
|                          |              |                 |  | BAB62712.1  | phosphodiesterase 11A4                                                                                     | 409  | e-113 |
| NM_007441                |              |                 |  |             |                                                                                                            |      |       |
| NP_031467.1              | Mm.10112     | U:(C-D)<br>2.14 |  | NP_006483.1 | aristaless-like homeobox 3                                                                                 | 516  | e-146 |
|                          |              |                 |  | O95076      | ALX3_HUMAN Homeobox protein aristaless-like 3 (Proline-rich transcription factor ALX3)                     | 516  | e-146 |
|                          |              |                 |  | AAD01418.1  | homeobox protein                                                                                           | 516  | e-146 |
| NM_017394<br>NP_059090.1 | Mm.3556<br>7 | U:(C-D)<br>2.14 |  | NP_062823.1 | solute carrier family 7, member 10; asc-type amino acid transporter 1                                      | 904  | 0     |
|                          |              |                 |  | Q9NS82      | AAA1_HUMAN Asc-type amino acid transporter 1 (Asc-1)                                                       | 904  | 0     |
|                          |              |                 |  | BAB03213.1  | asc-type amino acid transporter 1                                                                          | 904  | 0     |
|                          |              |                 |  | AAK93960.1  | AF340165_1 amino acid transporter                                                                          | 904  | 0     |
|                          |              |                 |  | CAC81900.1  | ASC1 protein                                                                                               | 904  | 0     |
|                          |              |                 |  | AAH35627.1  | similar to solute carrier family 7                                                                         | 904  | 0     |
|                          |              |                 |  | Q9UH15      | LAT2_HUMAN Large neutral amino acids transporter small subunit 2 (L-type amino acid transporter 2) (hLAT2) | 669  | 0     |
|                          |              |                 |  | AAF20381.1  | AF171669_1 glycoprotein-associated amino acid transporter LAT2                                             | 669  | 0     |
|                          |              |                 |  | BAB21519.1  | L-type amino acid transporter 2                                                                            | 669  | 0     |
|                          |              |                 |  | NP_036376.1 | solute carrier family 7 (cationic amino acid transporter, y <sup>+</sup> system), member 8                 | 666  | 0     |
|                          |              |                 |  | CAB40137.1  | SLC7A8 protein                                                                                             | 666  | 0     |

|            |         |              |  |             |          |                                                                                                                                                                                                  |     |          |
|------------|---------|--------------|--|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|            |         |              |  | AAF05695.1  | AF135828 | 1 L amino acid transporter-2; LAT-2                                                                                                                                                              | 534 | e-151    |
|            |         |              |  | NP_003477.2 |          | solute carrier family 7 (cationic amino acid transporter, y <sup>+</sup> system), member 5; Membrane protein E16; Solute carrier family 7, member 5; 4F2 light chain                             | 436 | e-122    |
|            |         |              |  | Q01650      |          | LAT1_HUMAN Large neutral amino acids transporter small subunit 1 (L-type amino acid transporter 1) (4F2 light chain) (4F2 LC) (4F2LC) (CD98 light chain) (Integral membrane protein E16) (hLAT1) | 436 | e-122    |
|            |         |              |  | JG0165      |          | LAT1 protein                                                                                                                                                                                     | 436 | e-122    |
|            |         |              |  | BAA33851.1  |          | CD98 light chain                                                                                                                                                                                 | 436 | e-122    |
|            |         |              |  | AAD20464.1  |          | L-type amino acid transporter subunit LAT1                                                                                                                                                       | 436 | e-122    |
|            |         |              |  | BAA84648.1  |          | L-type amino acid transporter 1                                                                                                                                                                  | 436 | e-122    |
|            |         |              |  | AAC61479.1  |          | amino acid transporter E16                                                                                                                                                                       | 436 | e-122    |
|            |         |              |  | AAH39692.1  |          | Similar to solute carrier family 7 (cationic amino acid transporter, y <sup>+</sup> system), member 5                                                                                            | 436 | e-122    |
|            |         |              |  | BAA75746.1  |          | 4F2 light chain                                                                                                                                                                                  | 434 | e-121    |
|            |         |              |  | BAB70708.1  |          | sodium-independent neutral amino acid transporter LAT1                                                                                                                                           | 434 | e-121    |
|            |         |              |  | NP_003974.1 |          | solute carrier family 7 (cationic amino acid transporter, y <sup>+</sup> system), member 6                                                                                                       | 431 | e-120    |
|            |         |              |  | BAA13376.1  |          | Similar to Schistosoma mansoni amino acid permease (L25068).                                                                                                                                     | 431 | e-120    |
|            |         |              |  | AAH28216.1  |          | solute carrier family 7 (cationic amino acid transporter, y <sup>+</sup> system), member 6                                                                                                       | 431 | e-120    |
| AK018130   |         |              |  |             |          |                                                                                                                                                                                                  |     |          |
| BAB31085.1 | Mm.5202 | U:(C-D) 2.13 |  | D59433      |          | C. elegans protein Z37093 homolog [imported]                                                                                                                                                     | 739 | 0        |
|            |         |              |  | BAA13212.1  |          | similar to C.elegans protein (Z37093)                                                                                                                                                            | 739 | 0        |
|            |         |              |  | AAC03237.1  |          | D1013901                                                                                                                                                                                         | 739 | 0        |
|            |         |              |  | XP_037574.1 |          | similar to PTPL1-associated RhoGAP 1                                                                                                                                                             | 739 | 0        |
|            |         |              |  | AAN04658.1  |          | minor histocompatibility antigen HA-1                                                                                                                                                            | 739 | 0        |
|            |         |              |  | AAH35564.1  |          | Similar to PTPL1-associated RhoGAP 1                                                                                                                                                             | 739 | 0        |
|            |         |              |  | NP_004806.1 |          | PTPL1-associated RhoGAP 1                                                                                                                                                                        | 278 | 2.00e-74 |
|            |         |              |  | E59430      |          | PTPL1-associated RhoGAP protein 1 [imported]                                                                                                                                                     | 278 | 2.00e-74 |

|            |          |                 |  |             |                                                                                                    |  |      |          |
|------------|----------|-----------------|--|-------------|----------------------------------------------------------------------------------------------------|--|------|----------|
|            |          |                 |  | AAB81012.1  | PTPL1-associated RhoGAP                                                                            |  | 278  | 2.00e-74 |
|            |          |                 |  | NP_057657.1 | Gem-interacting protein                                                                            |  | 265  | 2.00e-70 |
|            |          |                 |  | D59435      | Gem-interacting protein [imported]                                                                 |  | 265  | 2.00e-70 |
|            |          |                 |  | AAF61330.1  | AF132541_1 Gem-interacting protein                                                                 |  | 265  | 2.00e-70 |
| AK014320   |          |                 |  |             |                                                                                                    |  |      |          |
| BAB29271.1 | Mm.30114 | U:(C-D)<br>2.12 |  | AAL14103.1  | AF391100_1 alsin                                                                                   |  | 1569 | 0        |
|            |          |                 |  | BAB13389.2  | KIAA1563 protein                                                                                   |  | 1569 | 0        |
|            |          |                 |  | NP_065970.1 | alsin                                                                                              |  | 1569 | 0        |
|            |          |                 |  | BAB69014.1  | long form                                                                                          |  | 1569 | 0        |
|            |          |                 |  | NP_667340.1 | hypothetical protein LOC259173                                                                     |  | 244  | 5.00e-64 |
|            |          |                 |  | BAC04237.1  | unnamed protein product                                                                            |  | 244  | 5.00e-64 |
|            |          |                 |  | BAB84944.1  | FLJ00189 protein                                                                                   |  | 244  | 9.00e-64 |
| AK014599   |          |                 |  |             |                                                                                                    |  |      |          |
| BAB29454.1 | Mm.66017 | U:(C-D)<br>2.12 |  | AAD43186.1  | AC006029_1 Similar to Sperm Surface Protein PH-20; Similar to P38568 (PID:585674)                  |  | 749  | 0        |
|            |          |                 |  | NP_036401.1 | hyaluronoglucosaminidase 4                                                                         |  | 749  | 0        |
|            |          |                 |  | AAC98883.1  | hyaluronidase 4                                                                                    |  | 749  | 0        |
|            |          |                 |  | NP_694859.1 | sperm adhesion molecule 1 isoform 2; sperm surface protein PH-20; hyaluronoglucosaminidase         |  | 385  | e-106    |
|            |          |                 |  | P38567      | HYAP_HUMAN Hyaluronidase PH-20 precursor (Sperm surface protein PH-20) (Sperm adhesion molecule 1) |  | 385  | e-106    |
|            |          |                 |  | CAA59086.1  | sperm adhesion molecule gene SPAM1                                                                 |  | 385  | e-106    |
|            |          |                 |  | NP_003108.2 | sperm adhesion molecule 1 isoform 1; sperm surface protein PH-20; hyaluronoglucosaminidase         |  | 385  | e-106    |
|            |          |                 |  | AAH26163.1  | sperm adhesion molecule 1 (PH-20 hyaluronidase, zona pellucida binding)                            |  | 385  | e-106    |
|            |          |                 |  | AAC60607.2  | PH-20                                                                                              |  | 382  | e-105    |
|            |          |                 |  | S40465      | sperm protein PH-20                                                                                |  | 382  | e-105    |

|             |         |  |  |         |             |                                                                                                                                                                                                                     |      |          |
|-------------|---------|--|--|---------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|             |         |  |  |         | AAD24460.1  | AF118821_1 hyaluronoglucosaminidase 1 isoform 2                                                                                                                                                                     | 337  | 9.00e-92 |
|             |         |  |  |         | AAD53277.1  | AF173154_1 hyaluronoglucosaminidase 1 isoform 2                                                                                                                                                                     | 337  | 9.00e-92 |
|             |         |  |  |         | NP_009296.1 | hyaluronoglucosaminidase 1 isoform 1; hyaluronidase 1; tumor suppressor LUCA-1; plasma hyaluronidase; hyaluronoglucosaminidase                                                                                      | 336  | 1.00e-91 |
|             |         |  |  |         | NP_149349.2 | hyaluronoglucosaminidase 1 isoform 1; hyaluronidase 1; tumor suppressor LUCA-1; plasma hyaluronidase; hyaluronoglucosaminidase                                                                                      | 336  | 1.00e-91 |
|             |         |  |  |         | NP_695013.1 | hyaluronoglucosaminidase 1 isoform 1; hyaluronidase 1; tumor suppressor LUCA-1; plasma hyaluronidase; hyaluronoglucosaminidase                                                                                      | 336  | 1.00e-91 |
|             |         |  |  |         | AAD04190.1  | hyaluronoglucosaminidase 1                                                                                                                                                                                          | 336  | 1.00e-91 |
|             |         |  |  |         | AAD09137.2  | putative tumor suppressor                                                                                                                                                                                           | 336  | 1.00e-91 |
|             |         |  |  |         | AAH35695.1  | hyaluronoglucosaminidase 1                                                                                                                                                                                          | 336  | 1.00e-91 |
|             |         |  |  |         | JC5584      | hyaluronoglucosaminidase (EC 3.2.1.35) 1 precursor                                                                                                                                                                  | 333  | 7.00e-91 |
| NM_008969   |         |  |  | U:(C-D) |             | rostaglandin-endoperoxide synthase 1, isoform 1 precursor; prostaglandin G/H synthase and cyclooxygenase; PGH synthase 1; PG synthetase; prostaglandin synthetase; cyclooxygenase-1; prostaglandin H2 synthetase 1  | 1043 | 0        |
| NP_032995.1 | Mm.2792 |  |  | 2.12    | NP_000953.2 | PGH1_HUMAN Prostaglandin G/H synthase 1 precursor (Cyclooxygenase -1) (COX-1) (Prostaglandin-endoperoxide synthase 1) (Prostaglandin H2 synthase 1) (PGH synthase 1) (PGHS-1) (PHS 1)                               | 1043 | 0        |
|             |         |  |  |         | P23219      |                                                                                                                                                                                                                     | 1043 | 0        |
|             |         |  |  |         | JH0259      | prostaglandin-endoperoxide synthase (EC 1.14.99.1) 1 precursor                                                                                                                                                      | 1043 | 0        |
|             |         |  |  |         | AA03630.1   | prostaglandin endoperoxide synthase                                                                                                                                                                                 | 1043 | 0        |
|             |         |  |  |         | AAB21215.1  | prostaglandin endoperoxide synthase; cyclooxygenase                                                                                                                                                                 | 1043 | 0        |
|             |         |  |  |         | AAB22217.1  | prostaglandin G/H synthase; PGG/HS                                                                                                                                                                                  | 1043 | 0        |
|             |         |  |  |         | AAL33601.1  | AF440204_1 prostaglandin-endoperoxide synthase 1                                                                                                                                                                    | 1043 | 0        |
|             |         |  |  |         | AAH29840.1  | Unknown (protein for MGC:34214)                                                                                                                                                                                     | 1043 | 0        |
|             |         |  |  |         | AAA36439.1  | prostaglandin-endoperoxide synthase-1                                                                                                                                                                               | 1038 | 0        |
|             |         |  |  |         |             | prostaglandin-endoperoxide synthase 1, isoform 2 precursor; prostaglandin G/H synthase and cyclooxygenase; PGH synthase 1; PG synthetase; prostaglandin synthetase; cyclooxygenase-1; prostaglandin H2 synthetase 1 | 956  | 0        |
|             |         |  |  |         | NP_542158.1 |                                                                                                                                                                                                                     | 956  | 0        |
|             |         |  |  |         | AAB22216.1  | prostaglandin G/H synthase; PGG/HS                                                                                                                                                                                  | 956  | 0        |

|                          |  |                 |                        |             |                                                                                                                                                                                                                           |     |          |
|--------------------------|--|-----------------|------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |  |                 |                        | NP_000954.1 | prostaglandin-endoperoxide synthase 2 precursor; prostaglandin G/H synthase and cyclooxygenase; cyclooxygenase-2; endoperoxide synthase type II; prostaglandin H synthase type 2; prostaglandin synthase-2; PG synthetase | 729 | 0        |
|                          |  |                 |                        | P35354      | PGH2_HUMAN Prostaglandin G/H synthase 2 precursor (Cyclooxygenase -2) (COX-2)(Prostaglandin-endoperoxide synthase 2) (Prostaglandin H2 synthase 2) (PGH synthase 2) (PGHS-2) (PHS II)                                     | 729 | 0        |
|                          |  |                 |                        | AAA57317.1  | cyclooxygenase-2                                                                                                                                                                                                          | 729 | 0        |
|                          |  |                 |                        | BAA05698.1  | prostaglandin endoperoxide synthase-2                                                                                                                                                                                     | 729 | 0        |
|                          |  |                 |                        | CAB41240.1  | PTGS2 (prostaglandin-endoperoxide synthase 2 (prostaglandin G/H synthase and cyclooxygenase))                                                                                                                             | 729 | 0        |
|                          |  |                 |                        | AAH13734.1  | AAH13734 prostaglandin-endoperoxide synthase 2 (prostaglandin G/H synthase and cyclooxygenase)                                                                                                                            | 729 | 0        |
|                          |  |                 |                        | A46150      | prostaglandin-endoperoxide synthase (EC 1.14.99.1) 2 precursor                                                                                                                                                            | 729 | 0        |
|                          |  |                 |                        | AAA58433.1  | cyclooxygenase-2                                                                                                                                                                                                          | 729 | 0        |
|                          |  |                 |                        | AAA35803.1  | endoperoxide synthase type II                                                                                                                                                                                             | 727 | 0        |
|                          |  |                 |                        | AAN52932.1  | cyclooxygenase 2b                                                                                                                                                                                                         | 380 | e-105    |
| NM_010225<br>NP_034355.1 |  | U:(C-D)<br>2.11 | NP_001443.1<br>Mm.6260 | NP_001443.1 | forkhead box F2; forkhead (Drosophila)-like 6                                                                                                                                                                             | 521 | e-147    |
|                          |  |                 |                        | Q12947      | FXF2_HUMAN Forkhead box protein F2 (Forkhead-related protein FKHL6) (Forkhead-related transcription factor 2) (FREAC-2) (Forkhead-related activator-2)                                                                    | 521 | e-147    |
|                          |  |                 |                        | T09474      | forkhead protein FREAC-2                                                                                                                                                                                                  | 521 | e-147    |
|                          |  |                 |                        | AAC32226.1  | forkhead protein FREAC-2                                                                                                                                                                                                  | 521 | e-147    |
|                          |  |                 |                        | AAD19875.1  | forkhead transcription factor                                                                                                                                                                                             | 521 | e-147    |
|                          |  |                 |                        | 2208384B    | transcription factor FREAC-2                                                                                                                                                                                              | 508 | e-143    |
|                          |  |                 |                        | NP_001442.1 | forkhead box F1; forkhead (Drosophila)-like 5; Forkhead, drosophila, homolog-like 5; forkhead-related activator 1 [Homo sapiens]                                                                                          | 251 | 3.00e-66 |
|                          |  |                 |                        | Q12946      | FXF1_HUMAN Forkhead box protein F1 (Forkhead-related protein FKHL5) (Forkhead-related transcription factor 1) (FREAC-1) (Forkhead-related activator-1)                                                                    | 251 | 3.00e-66 |

|             |         |         |  |             |                                                                                          |  |     |          |
|-------------|---------|---------|--|-------------|------------------------------------------------------------------------------------------|--|-----|----------|
|             |         |         |  | AAC50399.1  | FREAC-1                                                                                  |  | 251 | 3.00e-66 |
|             |         |         |  | AAC61576.1  | forkhead transcription factor                                                            |  | 251 | 3.00e-66 |
|             |         |         |  | 2208384A    | transcription factor FREAC-1                                                             |  | 251 | 3.00e-66 |
| NM_028770   | Mm.3338 | U:(C-D) |  | XP_096612.2 | similar to RIKEN cDNA 1200016G03                                                         |  | 561 | e-159    |
| NP_083046.1 | 5       | 2.1     |  | CAB76832.1  | cytokeratin                                                                              |  | 270 | 6.00e-72 |
|             |         |         |  | NP_004684.1 | cytokeratin type II                                                                      |  | 270 | 1.00e-71 |
|             |         |         |  | CAA76730.1  | cytokeratin type II                                                                      |  | 270 | 1.00e-71 |
|             |         |         |  | AAH24292.1  | keratin 5 (epidermolysis bullosa simplex, Dowling-Meara/Kobner/Weber-Cockayne types)     |  | 261 | 5.00e-69 |
|             |         |         |  | AAA36145.1  | keratin K5                                                                               |  | 260 | 7.00e-69 |
|             |         |         |  | NP_000415.1 | keratin 5; Keratin-5; 58 kda cytokeratin; keratin, type II cytoskeletal 5; cytokeratin 5 |  | 260 | 7.00e-69 |
|             |         |         |  | P13647      | K2C5_HUMAN Keratin, type II cytoskeletal 5 (Cytokeratin 5) (CK 5) (58 kDa cytokeratin)   |  | 260 | 7.00e-69 |
|             |         |         |  | A29904      | keratin 5, type II, epidermal                                                            |  | 260 | 7.00e-69 |
|             |         |         |  | AAA36143.1  | keratin type II                                                                          |  | 260 | 7.00e-69 |
|             |         |         |  | AAF97931.1  | AF274874_1 keratin 5                                                                     |  | 260 | 7.00e-69 |
|             |         |         |  | NP_002264.1 | keratin 8; Keratin-8                                                                     |  | 259 | 1.00e-68 |
|             |         |         |  | CAA52882.1  | Keratin 8                                                                                |  | 259 | 1.00e-68 |
|             |         |         |  | AAB18966.1  | human cytokeratin 8                                                                      |  | 259 | 1.00e-68 |
|             |         |         |  | AAH00654.1  | AAH00654 keratin 8                                                                       |  | 259 | 1.00e-68 |
|             |         |         |  | A34720      | keratin 8, type II cytoskeletal                                                          |  | 259 | 1.00e-68 |
|             |         |         |  | P05787      | K2C8_HUMAN Keratin, type II cytoskeletal 8 (Cytokeratin 8) (CK 8)                        |  | 259 | 1.00e-68 |
|             |         |         |  | AAA35763.1  | cytokeratin 8                                                                            |  | 259 | 1.00e-68 |
| NM_011671   | Mm.1444 | U:(C-D) |  | NP_003346.2 | uncoupling protein 2                                                                     |  | 585 | e-167    |
| NP_035801.1 | 13      | 2.09    |  | P55851      | UCP2_HUMAN Mitochondrial uncoupling protein 2 (UCP 2) (UCPH)                             |  | 585 | e-167    |
|             |         |         |  | AAC51336.1  | UCP2                                                                                     |  | 585 | e-167    |



|                          |              |                 |  |             |                                                                               |     |          |
|--------------------------|--------------|-----------------|--|-------------|-------------------------------------------------------------------------------|-----|----------|
|                          |              |                 |  | AAC39690.1  | uncoupling protein 2                                                          | 585 | e-167    |
|                          |              |                 |  | AAD21151.1  | uncoupling protein-2                                                          | 585 | e-167    |
|                          |              |                 |  | AAH11737.1  | AAH11737 uncoupling protein 2 (mitochondrial, proton carrier)                 | 585 | e-167    |
|                          |              |                 |  | AAB53091.1  | uncoupling protein homolog                                                    | 583 | e-166    |
|                          |              |                 |  | CAA11402.1  | uncoupling protein 2                                                          | 583 | e-166    |
|                          |              |                 |  | AAB48411.1  | uncoupling protein-2                                                          | 583 | e-166    |
|                          |              |                 |  | NP_003347.1 | uncoupling protein 3, isoform UCP3L                                           | 451 | e-127    |
|                          |              |                 |  | P55916      | UCP3_HUMAN Mitochondrial uncoupling protein 3 (UCP 3)                         | 451 | e-127    |
|                          |              |                 |  | JC5522      | uncoupling protein UCP3, mitochondrial                                        | 451 | e-127    |
|                          |              |                 |  | AAC51367.1  | UCP3                                                                          | 451 | e-127    |
|                          |              |                 |  | AAC51369.1  | uncoupling protein 3                                                          | 451 | e-127    |
|                          |              |                 |  | AAC51767.1  | uncoupling protein-3                                                          | 451 | e-127    |
|                          |              |                 |  | AAG02284.1  | AF050113_1 uncoupling protein-3                                               | 451 | e-127    |
|                          |              |                 |  | AAC18822.1  | uncoupling protein 3                                                          | 445 | e-125    |
|                          |              |                 |  | AAC51785.1  | uncoupling protein 3                                                          | 432 | e-121    |
|                          |              |                 |  | NP_073714.1 | uncoupling protein 3, isoform UCP3S                                           | 392 | e-109    |
|                          |              |                 |  | AAC51356.1  | UCP3S                                                                         | 392 | e-109    |
|                          |              |                 |  | NP_068605.1 | uncoupling protein 1; mitochondrial brown fat uncoupling protein              | 353 | 2.00e-97 |
|                          |              |                 |  | G01858      | uncoupling protein 1, mitochondrial                                           | 353 | 2.00e-97 |
|                          |              |                 |  | AAA85271.1  | uncoupling protein                                                            | 353 | 2.00e-97 |
|                          |              |                 |  | P25874      | UCP1_HUMAN Mitochondrial brown fat uncoupling protein 1 (UCP 1) (Thermogenin) | 350 | 2.00e-96 |
|                          |              |                 |  | CAA36214.1  | uncoupling protein                                                            | 250 | 2.00e-96 |
|                          |              |                 |  | AAH08392.1  | AAH08392 Similar to uncoupling protein 3 (mitochondrial, proton carrier)      | 206 | 5.00e-53 |
| NM_011933<br>NP_036063.1 | Mm.3576<br>0 | U:(C-D)<br>2.09 |  | NP_065715.1 | peroxisomal 2,4-dienoyl-CoA reductase                                         | 466 | e-131    |

|                          |               |                 |  |             |                                                                                                                                                                  |      |       |
|--------------------------|---------------|-----------------|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|                          |               |                 |  | CAB92744.1  | c359F1.1 (novel protein (ortholog of mouse and rat peroxisomal 2,4-dienoyl-coA reductase (PDCR, DCR-AKL)))                                                       | 466  | e-131 |
|                          |               |                 |  | CAC05664.1  | peroxisomal 2,4-dienoyl-CoA reductase                                                                                                                            | 466  | e-131 |
|                          |               |                 |  | AAK61231.1  | AE006463_11 2-4-dienoyl-Coenzyme A reductase 2 peroxisomal like                                                                                                  | 466  | e-131 |
|                          |               |                 |  | AAH10740.1  | AAH10740 2,4-dienoyl CoA reductase 2, peroxisomal                                                                                                                | 466  | e-131 |
|                          |               |                 |  | AAH11968.1  | AAH11968 Similar to 2,4-dienoyl CoA reductase 2, peroxisomal                                                                                                     | 370  | e-102 |
| NM_019424<br>NP_062297.1 | Mm.1948<br>06 | U:(C-D)<br>2.08 |  | AAL50684.1  | AF450133_1 Hermansky-Pudlak syndrome                                                                                                                             | 1065 | 0     |
|                          |               |                 |  | NP_000186.1 | Hermansky-Pudlak syndrome protein; Hermansky-Pudlak syndrome gene; Hermansky-Pudlak syndrome                                                                     | 1064 | 0     |
|                          |               |                 |  | Q92902      | HPS1 HUMAN Hermansky-Pudlak syndrome 1 protein                                                                                                                   | 1064 | 0     |
|                          |               |                 |  | AAB17869.1  | Hermansky-Pudlak syndrome protein                                                                                                                                | 1064 | 0     |
|                          |               |                 |  | AAB70662.1  | Hermansky-Pudlak syndrome protein                                                                                                                                | 998  | 0     |
|                          |               |                 |  | AAH00175.1  | AAH00175 Hermansky-Pudlak syndrome                                                                                                                               | 411  | e-114 |
|                          |               |                 |  | AAC52074.1  | alternative Hermansky-Pudlak syndrome associated protein                                                                                                         | 409  | e-114 |
| NM_008433                |               |                 |  |             |                                                                                                                                                                  |      |       |
| NP_032459.1              | Mm.9911       | U:(C-D)<br>2.06 |  | NP_002241.1 | intermediate conductance calcium-activated potassium channel protein 1; putative erythrocyte intermediate conductance calcium-activated potassium Gardos channel | 607  | e-173 |
|                          |               |                 |  | O15554      | KCN4_HUMAN Intermediate conductance calcium-activated potassium channel protein 4 (SK4) (KCa4) (IKCa1) (Putative Gardos channel)                                 | 607  | e-173 |
|                          |               |                 |  | AAB82739.1  | calcium-activated potassium channel                                                                                                                              | 607  | e-173 |
|                          |               |                 |  | AAC36804.1  | intermediate conductance calcium-activated potassium channel                                                                                                     | 607  | e-173 |
|                          |               |                 |  | AAC23541.1  | hIK1                                                                                                                                                             | 607  | e-173 |
|                          |               |                 |  | AAC51913.1  | intermediate conductance calcium-activated potassium channel                                                                                                     | 607  | e-173 |
|                          |               |                 |  | AAG26917.1  | intermediate-conductance calcium-activated potassium channel 1                                                                                                   | 607  | e-173 |
|                          |               |                 |  | AAH15337.1  | potassium intermediate/small conductance calcium-activated channel, subfamily N, member 4                                                                        | 607  | e-173 |

|                          |              |                 |  |  |             |                                                                                                                                                |     |          |
|--------------------------|--------------|-----------------|--|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |              |                 |  |  | AAK81862.1  | AF395661_1 potassium intermediate/small conductance calcium-activated channel, subfamily N, member 4                                           | 606 | e-173    |
|                          |              |                 |  |  | AAL10706.1  | small-conductance calcium-activated potassium channel SK3                                                                                      | 286 | 5.00e-77 |
|                          |              |                 |  |  | NP_002240.2 | small conductance calcium-activated potassium channel protein 3 isoform a                                                                      | 285 | 1.00e-76 |
|                          |              |                 |  |  | Q9UGI6      | KCN3_HUMAN Small conductance calcium-activated potassium channel protein 3 (SK3) (SKCa3)                                                       | 285 | 1.00e-76 |
|                          |              |                 |  |  | CAB61331.1  | SK3 protein                                                                                                                                    | 285 | 1.00e-76 |
|                          |              |                 |  |  | AAK15345.1  | AF336797_1 small-conductance calcium-activated potassium channel                                                                               | 285 | 1.00e-76 |
|                          |              |                 |  |  | T09172      | probable calcium-activated potassium channel KCNN3                                                                                             | 282 | 1.00e-75 |
|                          |              |                 |  |  | AAC26099.1  | calcium-activated potassium channel                                                                                                            | 282 | 1.00e-75 |
|                          |              |                 |  |  | Q92952      | KCN1_HUMAN Small conductance calcium-activated potassium channel protein 1 (SK1)                                                               | 278 | 2.00e-75 |
|                          |              |                 |  |  | AAB09562.1  | small-conductance, calcium-activated potassium channel SK1                                                                                     | 278 | 2.00e-75 |
|                          |              |                 |  |  | AAD37507.1  | small-conductance calcium-activated potassium channel 1                                                                                        | 278 | 2.00e-75 |
|                          |              |                 |  |  | NP_002239.2 | small conductance calcium-activated potassium channel protein 1                                                                                | 278 | 2.00e-75 |
|                          |              |                 |  |  | AAK84039.1  | AF397175_1 small-conductance calcium-activated potassium channel                                                                               | 280 | 5.00e-75 |
|                          |              |                 |  |  | Q9H2S1      | KCN2_HUMAN Small conductance calcium-activated potassium channel protein 2 (SK2)                                                               | 279 | 7.00e-75 |
|                          |              |                 |  |  | AAG16728.1  | AF239613_1 apamin-sensitive small-conductance Ca2+-activated potassium channel                                                                 | 279 | 7.00e-75 |
|                          |              |                 |  |  | NP_067627.2 | small conductance calcium-activated potassium channel protein 2 isoform a; apamin-sensitive small-conductance Ca2+-activated potassium channel | 279 | 7.00e-75 |
| NM_013486<br>NP_038514.1 | Mm.2284<br>2 | U:(C-D)<br>2.06 |  |  | RWHUC2      | T-cell surface glycoprotein CD2 precursor                                                                                                      | 255 | 1.00e-67 |
|                          |              |                 |  |  | AAA35571.1  | T-cell surface antigen CD2 precursor                                                                                                           | 255 | 1.00e-67 |
|                          |              |                 |  |  | AAA53095.1  | TI1 surface antigen                                                                                                                            | 255 | 1.00e-67 |
|                          |              |                 |  |  | CAC14840.1  | dJ655N15.1 (CD2 antigen (p50), sheep red blood cell receptor)                                                                                  | 255 | 1.00e-67 |
|                          |              |                 |  |  | AAA51946.1  | CD2 surface antigen                                                                                                                            | 255 | 1.00e-67 |
|                          |              |                 |  |  | NP_001758.1 | CD2 antigen (p50), sheep red blood cell receptor; lymphocyte-function antigen-2                                                                | 252 | 8.00e-67 |

|             |         |         |  |             |                                                                                                                                                               |     |          |
|-------------|---------|---------|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
|             |         |         |  | P06729      | CD2_HUMAN T-cell surface antigen CD2 precursor (T-cell surface antigen T11/Leu-5) (LFA-2) (LFA-3 receptor) (Erythrocyte receptor) (Rosette receptor)          | 252 | 8.00e-67 |
|             |         |         |  | AAA51738.1  | surface antigen CD2 precursor                                                                                                                                 | 252 | 8.00e-67 |
|             |         |         |  | CAA30721.1  | T-cell surface antigen                                                                                                                                        | 252 | 8.00e-67 |
|             |         |         |  | AAH33583.1  | CD2 antigen (p50), sheep red blood cell receptor                                                                                                              | 252 | 8.00e-67 |
| NM_029796   | Mm.1769 | U:(C-D) |  | NP_443204.1 | leucine-rich alpha-2-glycoprotein                                                                                                                             | 330 | 3.00e-90 |
| NP_084072.1 | 46      | 2.06    |  | P02750      | A2GL_HUMAN Leucine-rich alpha-2-glycoprotein precursor (LRG)                                                                                                  | 330 | 3.00e-90 |
|             |         |         |  | AAK95527.1  | AF403428_1 leucine-rich alpha-2-glycoprotein                                                                                                                  | 330 | 3.00e-90 |
|             |         |         |  | NBHUA2      | leucine-rich alpha-2-glycoprotein                                                                                                                             | 329 | 6.00e-90 |
|             |         |         |  | AAH34389.1  | leucine-rich alpha-2-glycoprotein                                                                                                                             | 327 | 2.00e-89 |
| X71479      |         | U:(C-D) |  | CAA50586.1  | cytochrome P450                                                                                                                                               | 268 | 2.00e-72 |
| CAA50585.1  | NULL    | 2.06    |  | NP_000769.1 | cytochrome P450, subfamily IVA, polypeptide 11; fatty acid omega-hydroxylase; P450HLL-omega; alkane-1 monooxygenase; lauric acid omega-hydroxylase            | 267 | 4.00e-72 |
|             |         |         |  | I53015      | fatty acid omega-hydroxylase (EC 1.14.15.-) cytochrome P450 4A11                                                                                              | 267 | 4.00e-72 |
|             |         |         |  | AAB29502.1  | fatty acid omega-hydroxylase; CYP4A11                                                                                                                         | 267 | 4.00e-72 |
|             |         |         |  | I65981      | fatty acid omega-hydroxylase (EC 1.14.15.-) cytochrome P450 4A11                                                                                              | 267 | 4.00e-72 |
|             |         |         |  | AAB29503.1  | fatty acid omega-hydroxylase; CYP4A11v                                                                                                                        | 267 | 4.00e-72 |
|             |         |         |  | Q02928      | CP4Y_HUMAN Cytochrome P450 4A11 precursor (CYP4A11) (Fatty acid omega-hydroxylase) (P-450 HK omega) (Lauric acid omega-hydroxylase) (CYP4AII) (P450-HL-omega) | 265 | 2.00e-71 |
|             |         |         |  | JX0331      | laurate omega-hydroxylase (EC 1.14.15.3) cytochrome P450 4A11 (HL24)                                                                                          | 265 | 2.00e-71 |
|             |         |         |  | AAA58436.1  | cytochrome P450                                                                                                                                               | 265 | 2.00e-71 |
|             |         |         |  | BAA05491.1  | fatty acids omega-hydroxylase (cytochrome P450HLL omega)                                                                                                      | 265 | 2.00e-71 |
|             |         |         |  | 1908216A    | fatty acid omega-hydroxylase (cytochrome P450 4A)                                                                                                             | 265 | 2.00e-71 |
|             |         |         |  | BAA02864.1  | fatty acid omega-hydroxylase                                                                                                                                  | 265 | 2.00e-71 |
|             |         |         |  | AAF76722.1  | AF208532_1 fatty acid omega-hydroxylase CYP4A11                                                                                                               | 261 | 2.00e-70 |

|                          |              |                                     |  |             |                                                                                                                         |     |          |
|--------------------------|--------------|-------------------------------------|--|-------------|-------------------------------------------------------------------------------------------------------------------------|-----|----------|
|                          |              |                                     |  | CAB72105.1  | dJ18D14.4 (cytochrome P450, subfamily IVA, polypeptide 11)                                                              | 253 | 6.00e-68 |
|                          |              |                                     |  | AAH28102.1  | Unknown (protein for MGC:40051)                                                                                         | 202 | 1.00e-52 |
|                          |              |                                     |  | BAC05226.1  | unnamed protein product                                                                                                 | 202 | 1.00e-52 |
|                          |              |                                     |  | BAC03751.1  | unnamed protein product                                                                                                 | 202 | 1.00e-52 |
| NM_019935<br>NP_064319.1 | Mm.3832<br>3 | U:(C-D)<br>2.05<br>U:(IR-D)<br>2.41 |  | O14753      | OVO1_HUMAN Putative transcription factor Ovo-like 1 (hOvo1)                                                             | 468 | e-131    |
|                          |              |                                     |  | NP_004552.1 | OVO-like 1 binding protein; putative transcription factor OVO-like 1; ovo (Drosophila) homolog-like 1                   | 367 | e-101    |
|                          |              |                                     |  | AAB72084.1  | OVO-like 1 binding protein                                                                                              | 367 | e-101    |
|                          |              |                                     |  | NP_067043.1 | zinc finger protein 339; ovo-like 2 (Drosophila)                                                                        | 275 | 3.00e-73 |
|                          |              |                                     |  | BAB14002.1  | unnamed protein product                                                                                                 | 275 | 3.00e-73 |
|                          |              |                                     |  | Q9BRP0      | Z339_HUMAN Zinc finger protein 339                                                                                      | 271 | 2.00e-72 |
|                          |              |                                     |  | AAH06148.1  | AAH06148 putative zinc finger protein from EUROMAGE 566589                                                              | 271 | 2.00e-72 |
|                          |              |                                     |  | CAB45151.1  | hypothetical protein, similar to (AF134804) putative zinc finger transcription factor OVO1 [Mus musculus]               | 238 | 3.00e-62 |
| NM_012006<br>NP_036136.1 | Mm.1978      | U:(C-D)<br>2.05                     |  | XP_170752.1 | similar to peroxisomal long-chain acyl-coA thioesterase; peroxisomal long-chain acyl-coA thioesterase; putative protein | 602 | e-172    |
|                          |              |                                     |  | P49753      | PTE2_HUMAN Peroxisomal acyl-coenzyme A thioester hydrolase 2 (Peroxisomal long-chain acyl-coA thioesterase 2) (ZAP128)  | 600 | e-171    |
|                          |              |                                     |  | JC7367      | second peroxisomal thioesterase                                                                                         | 600 | e-171    |
|                          |              |                                     |  | AAF97985.1  | peroxisomal long-chain acyl-coA thioesterase                                                                            | 600 | e-171    |
|                          |              |                                     |  | AAH04436.1  | AAH04436 Unknown (protein for MGC:3983)                                                                                 | 600 | e-171    |
|                          |              |                                     |  | AAH06500.1  | AAH06500 Unknown (protein for MGC:2366)                                                                                 | 600 | e-171    |
|                          |              |                                     |  | NP_006812.2 | peroxisomal long-chain acyl-coA thioesterase; peroxisomal long-chain acyl-coA thioesterase; putative protein            | 599 | e-171    |
|                          |              |                                     |  | AAH06335.1  | AAH06335 peroxisomal long-chain acyl-coA thioesterase                                                                   | 599 | e-171    |
|                          |              |                                     |  | BAA91989.1  | unnamed protein product                                                                                                 | 598 | e-171    |

|            |          |                 |             |                                                                                                                        |     |          |
|------------|----------|-----------------|-------------|------------------------------------------------------------------------------------------------------------------------|-----|----------|
|            |          |                 | NP_689544.1 | hypothetical protein FLJ31235                                                                                          | 494 | e-139    |
|            |          |                 | BAC04313.1  | unnamed protein product                                                                                                | 494 | e-139    |
|            |          |                 | AAC42007.1  | ORF; putative                                                                                                          | 405 | e-113    |
|            |          |                 | XP_090885.1 | similar to Peroxisomal acyl-coenzyme A thioester hydrolase 2 (Peroxisomal long-chain acyl-coA thioesterase 2) (ZAP128) | 280 | 4.00e-75 |
|            |          |                 | NP_001692.1 | bile acid Coenzyme A: amino acid N-acyltransferase; glycine N-choyltransferase                                         | 265 | 2.00e-70 |
|            |          |                 | A53965      | bile acid-CoA amino acid N-acyltransferase                                                                             | 265 | 2.00e-70 |
|            |          |                 | AAC37550.1  | bile acid CoA: Amino acid N-acyltransferase                                                                            | 265 | 2.00e-70 |
|            |          |                 | AAH09567.1  | AAH09567 bile acid Coenzyme A: amino acid N-acyltransferase (glycine N-choyltransferase)                               | 265 | 2.00e-70 |
| AK004963   |          |                 |             |                                                                                                                        |     |          |
| BAB23703.1 | Mm.186   | U:(C-D)<br>2.04 | NP_055419.1 | Tax interaction protein 1                                                                                              | 243 | 4.00e-64 |
|            |          |                 | AAB84248.2  | Tax interaction protein 1                                                                                              | 243 | 4.00e-64 |
|            |          |                 | AAG44368.1  | AF234997_1 glutaminase-interacting protein 3                                                                           | 243 | 4.00e-64 |
|            |          |                 | AAK69111.1  | AF277318_1 tax-interacting protein 1                                                                                   | 243 | 4.00e-64 |
|            |          |                 | AAH23980.1  | Tax interaction protein 1                                                                                              | 243 | 4.00e-64 |
|            |          |                 | AAF43104.1  | TIP1                                                                                                                   | 228 | 2.00e-59 |
| AK008849   |          |                 |             |                                                                                                                        |     |          |
| BAB25928.1 | Mm.45435 | U:(C-D)<br>2.04 | NP_079119.2 | duodenal cytochrome b; hypothetical protein FLJ23462                                                                   | 391 | e-109    |
|            |          |                 | CAB66628.1  | hypothetical protein                                                                                                   | 391 | e-109    |
|            |          |                 | BAB15661.1  | unnamed protein product                                                                                                | 386 | e-107    |
|            |          |                 |             | similar to data source:SPTR, source key:Q9H0Q8, evidence:ISS~homolog to HYPOTHETICAL 31.6 KDA PROTEIN~putative         | 196 | 6.00e-50 |
|            |          |                 | XP_166224.2 |                                                                                                                        | 196 | 6.00e-50 |
|            |          |                 | NP_705839.1 | hypothetical protein MGC20446                                                                                          | 196 | 6.00e-50 |
|            |          |                 | BAC11698.1  | unnamed protein product                                                                                                | 196 | 6.00e-50 |

|             |          |                 |        |             |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                             |      |     |          |
|-------------|----------|-----------------|--------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|----------|
| NM_008532   |          |                 |        |             |                                                                                                                                                                                                    | TTD1_HUMAN Tumor-associated calcium signal transducer 1 precursor (Major gastrointestinal tumor-associated protein GA733-2) (Epithelial cell surface antigen) (Epithelial glycoprotein) (EGP) (Adenocarcinoma-associated antigen) (KSA) (KS 1/4 antigen) (Cell surface glycoprotein Trop-1) |      |     | e-125    |
| NP_032558.1 | Mm.4259  | U:(C-D)<br>2.03 | P16422 | CAA32870.1  | KSA preproantigen peptide                                                                                                                                                                          |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAA36151.1  | adenocarcinoma-associated antigen precursor (KSA)                                                                                                                                                  |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAA59543.1  | KS1/4 antigen                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | NP_002345.1 | tumor-associated calcium signal transducer 1 precursor; membrane component, chromosome 4, surface marker (35kD glycoprotein); MK-1 antigen; antigen identified by monoclonal antibody AUA1         |                                                                                                                                                                                                                                                                                             | 446  |     | e-125    |
|             |          |                 |        | B48149      | epithelial glycoprotein antigen GA733-2 precursor                                                                                                                                                  |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAA35861.1  | carcinoma-associated antigen GA733-2                                                                                                                                                               |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAB00775.1  | carcinoma-associated antigen GA733-2                                                                                                                                                               |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAH14785.1  | tumor-associated calcium signal transducer 1                                                                                                                                                       |                                                                                                                                                                                                                                                                                             | 446  | 446 | e-125    |
|             |          |                 |        | AAA35723.1  | epithelial glycoprotein (EGP) precursor                                                                                                                                                            |                                                                                                                                                                                                                                                                                             | 444  | 444 | e-124    |
|             |          |                 |        | A48149      | carcinoma-associated antigen GA733-1 precursor                                                                                                                                                     |                                                                                                                                                                                                                                                                                             | 265  | 265 | 2.00e-70 |
|             |          |                 |        | CAA31781.1  | GA733-1 protein (AA 1-323)                                                                                                                                                                         |                                                                                                                                                                                                                                                                                             | 265  | 265 | 2.00e-70 |
|             |          |                 |        | CAA54801.1  | gp50/TROP-2                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                             | 265  | 265 | 2.00e-70 |
|             |          |                 |        | AAH09409.1  | Unknown (protein for MGC:10655)                                                                                                                                                                    |                                                                                                                                                                                                                                                                                             | 265  | 265 | 2.00e-70 |
|             |          |                 |        |             | tumor-associated calcium signal transducer 2 precursor; membrane component, chromosome 1, surface marker 1 (40kD glycoprotein, identified by monoclonal antibody GA733); epithelial glycoprotein-1 |                                                                                                                                                                                                                                                                                             | 263  | 263 | 6.00e-70 |
|             |          |                 |        | CAA54799.1  | gp50/Trop-2                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                             | 263  | 263 | 6.00e-70 |
|             |          |                 |        | P09758      | TTD2_HUMAN Tumor-associated calcium signal transducer 2 precursor (Pancreatic carcinoma marker protein GA733-1) (Cell surface glycoprotein Trop-2)                                                 |                                                                                                                                                                                                                                                                                             | 262  | 262 | 1.00e-69 |
|             |          |                 |        | AAA52505.1  | GA733-1 protein precursor                                                                                                                                                                          |                                                                                                                                                                                                                                                                                             | 262  | 262 | 1.00e-69 |
| NM_009780   |          |                 |        |             |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                             |      |     |          |
| NP_033910.1 | Mm.16106 | U:(C-D)<br>2.02 | P01028 |             | CO4_HUMAN Complement C4 precursor [Contains: C4A anaphylatoxin]                                                                                                                                    |                                                                                                                                                                                                                                                                                             | 2587 |     | 0        |

|             |         |              |  |             |                                                                                                                   |      |       |
|-------------|---------|--------------|--|-------------|-------------------------------------------------------------------------------------------------------------------|------|-------|
|             |         |              |  | C4HU        | complement C4A precursor [validated]                                                                              | 2586 | 0     |
|             |         |              |  | AAA51855.1  | complement component C4A                                                                                          | 2586 | 0     |
|             |         |              |  | NP_009224.1 | complement component 4A preproprotein; acidic C4; Rodgers form of C4; complement component 4S                     | 2583 | 0     |
|             |         |              |  | CAB89302.   | dJ34F7.4 (complement component 4A)                                                                                | 2582 | 0     |
|             |         |              |  | NP_000583.1 | complement component 4B preproprotein; Chido form of C4; basic C4; complement component 4F                        | 2581 | 0     |
|             |         |              |  | AAB67980.1  | complement component C4                                                                                           | 2581 | 0     |
|             |         |              |  | AAB59537.1  | complement component C4A                                                                                          | 2563 | 0     |
|             |         |              |  | AAA99717.1  | complement C4B precursor                                                                                          | 2465 | 0     |
|             |         |              |  | NP_000055.1 | complement component 3 precursor                                                                                  | 624  | e-178 |
|             |         |              |  | P01024      | CO3_HUMAN Complement C3 precursor                                                                                 | 624  | e-178 |
|             |         |              |  | C3HU        | complement C3 precursor [validated]                                                                               | 624  | e-178 |
|             |         |              |  | AAA85332.1  | complement component C3                                                                                           | 624  | e-178 |
|             |         |              |  | AAA59651.1  | complement component C4B                                                                                          | 573  | e-163 |
|             |         |              |  | IHZF        | A Chain A, C4adg Fragment Of Human Complement Factor C4a                                                          | 544  | e-154 |
| NM_008874   |         |              |  |             |                                                                                                                   |      |       |
| NP_032900.1 | Mm.6888 | U:(C-D)<br>2 |  | NP_000923.1 | phospholipase C, beta 3 (phosphatidylinositol-specific)                                                           | 2015 | 0     |
|             |         |              |  | Q01970      | PIP3_HUMAN 1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase beta 3 (PLC-beta-3) (Phospholipase C-beta-3) | 2015 | 0     |
|             |         |              |  | I38994      | phospholipase C-beta-3                                                                                            | 2015 | 0     |
|             |         |              |  | AAA77683.1  | phospholipase C-beta-3                                                                                            | 2015 | 0     |
|             |         |              |  | S52099      | phospholipase C beta 3                                                                                            | 1967 | 0     |
|             |         |              |  | CAA85776.1  | phospholipase C beta 3                                                                                            | 1967 | 0     |
|             |         |              |  | AAH32659.1  | Similar to phospholipase C, beta 3                                                                                | 1824 | 0     |
|             |         |              |  | S27002      | phospholipase C (EC 3.1.4.3), phosphatidylinositol-specific                                                       | 1663 | 0     |
|             |         |              |  | CAA78903.1  | phospholipase c                                                                                                   | 1663 | 0     |



|                          |              |              |  |  |             |                                                                                                                                                                                    |      |          |
|--------------------------|--------------|--------------|--|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
|                          |              |              |  |  | NP_056007.1 | phospholipase C, beta 1 (phosphoinositide-specific); phosphoinositide-specific phospholipase C-beta 1; phospholipase C beta 1; phospholipase C, beta 1 (phosphoinositide-specific) | 1197 | 0        |
|                          |              |              |  |  | Q9NQ66      | PIB1_HUMAN 1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase beta (PLC-beta-1) (Phospholipase C-beta-1) (PLC-1) (PLC-154)                                                  | 1197 | 0        |
|                          |              |              |  |  | CAB98142.1  | phospholipase C-beta-1a                                                                                                                                                            | 1197 | 0        |
|                          |              |              |  |  | CAB98143.1  | phospholipase C-beta-1b                                                                                                                                                            | 1192 | 0        |
|                          |              |              |  |  | AAF86613.1  | phospholipase C beta 1                                                                                                                                                             | 1154 | 0        |
|                          |              |              |  |  | BAA25507    | KIAA0581 protein                                                                                                                                                                   | 1047 | 0        |
|                          |              |              |  |  | NP_004564.1 | phospholipase C, beta 2                                                                                                                                                            | 934  | 0        |
|                          |              |              |  |  | Q00722      | PIB2_HUMAN 1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase beta 2 (PLC-beta-2) (Phospholipase C-beta-2)                                                                  | 934  | 0        |
|                          |              |              |  |  | A43346      | 1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase (EC 3.1.4.11) beta-2                                                                                                     | 934  | 0        |
|                          |              |              |  |  | AAA36453.1  | phospholipase C-beta-2                                                                                                                                                             | 934  | 0        |
|                          |              |              |  |  | T46339      | hypothetical protein DKFZp434A0814.1                                                                                                                                               | 885  | 0        |
|                          |              |              |  |  | CAB70666.1  | hypothetical protein                                                                                                                                                               | 885  | 0        |
| NM_010129<br>NP_034259.1 | Mm.2082<br>9 | U:(C-D)<br>2 |  |  | NP_001416.1 | epithelial membrane protein 3                                                                                                                                                      | 250  | 1.00e-66 |
|                          |              |              |  |  | P54852      | EMP3_HUMAN Epithelial membrane protein-3 (EMP-3) (YMP protein) (Hematopoietic neural membrane protein) (HNMP-1)                                                                    | 250  | 1.00e-66 |
|                          |              |              |  |  | AAC50920.1  | YMP                                                                                                                                                                                | 250  | 1.00e-66 |
|                          |              |              |  |  | AAC51730.1  | hematopoietic neural membrane protein                                                                                                                                              | 250  | 1.00e-66 |
|                          |              |              |  |  | AAH09718.1  | AAH09718 epithelial membrane protein 3                                                                                                                                             | 250  | 1.00e-66 |
|                          |              |              |  |  | JC5045      | epithelial membrane protein 3                                                                                                                                                      | 244  | 6.00e-65 |
|                          |              |              |  |  | CAA64394.1  | epithelial membrane protein-3                                                                                                                                                      | 244  | 6.00e-65 |
| NM_011644<br>NP_035774.1 | Mm.8361<br>5 | U:(C-D)<br>2 |  |  | NP_004612.2 | transient receptor potential cation channel, subfamily C, member 6; transient receptor potential channel 6                                                                         | 427  | e-119    |
|                          |              |              |  |  | Q9Y210      | TRP6_HUMAN Short transient receptor potential channel 6 (TrpC6)                                                                                                                    | 427  | e-119    |

|  |  |  |  |             |                                                                                                            |     |          |
|--|--|--|--|-------------|------------------------------------------------------------------------------------------------------------|-----|----------|
|  |  |  |  | CAA06943.1  | transient receptor potential protein                                                                       | 427 | e-119    |
|  |  |  |  | AAC63289.2  | transient receptor potential protein 6                                                                     | 427 | e-119    |
|  |  |  |  | CAC01684.1  | transient receptor potential channel 6                                                                     | 427 | e-119    |
|  |  |  |  | NP_003296.1 | transient receptor potential cation channel, subfamily C, member 3; transient receptor potential channel 3 | 421 | e-117    |
|  |  |  |  | Q13507      | TRP3_HUMAN Short transient receptor potential channel 3 (TrpC3) (Htrp3)                                    | 421 | e-117    |
|  |  |  |  | CAA74083.1  | transient receptor potential related channel 3 protein                                                     | 421 | e-117    |
|  |  |  |  | AAC51653.1  | calcium influx channel                                                                                     | 421 | e-117    |
|  |  |  |  | NP_065122.1 | putative capacitative calcium channel                                                                      | 411 | e-114    |
|  |  |  |  | Q9HCX4      | TRP7_HUMAN Short transient receptor potential channel 7 (TrpC7) (TRP7 protein)                             | 441 | e-114    |
|  |  |  |  | CAC03489.1  | putative capacitative calcium channel                                                                      | 411 | e-114    |
|  |  |  |  | CAD19069.1  | short transient receptor potential channel 7                                                               | 409 | e-113    |
|  |  |  |  | AAF22928.1  | AF063823_1 trp-related protein 4 truncated variant beta                                                    | 369 | e-101    |
|  |  |  |  | AAL24550.1  | AF421359_1 transient receptor potential channel 4 beta splice variant                                      | 369 | e-101    |
|  |  |  |  | AAL24551.1  | AF421360_1 transient receptor potential channel 4 epsilon splice variant                                   | 369 | e-101    |
|  |  |  |  | NP_057263.1 | transient receptor potential 4; transient receptor potential channel 4                                     | 369 | e-101    |
|  |  |  |  | Q9UBN4      | TRP4_HUMAN Short transient receptor potential channel 4 (TrpC4) (trp-related protein 4) (hTrp-4) (hTrp4)   | 369 | e-101    |
|  |  |  |  | AAD51736.1  | AF175406_1 transient receptor potential 4                                                                  | 369 | e-101    |
|  |  |  |  | AAF22927.1  | AF063822_1 trp-related protein 4                                                                           | 369 | e-101    |
|  |  |  |  | AAL24549.1  | AF421358_1 transient receptor potential channel 4 alpha splice variant                                     | 369 | e-101    |
|  |  |  |  | AAF22929.1  | AF063824_1 trp-related protein 4 truncated variant delta                                                   | 369 | e-101    |
|  |  |  |  | NP_036603.1 | transient receptor potential cation channel, subfamily C, member 5; transient receptor potential channel 5 | 359 | 2.00e-98 |
|  |  |  |  | Q9UL62      | TRP5_HUMAN Short transient receptor potential channel 5 (TrpC5) (Htrp-5) (Htrp5)                           | 359 | 2.00e-98 |
|  |  |  |  | AAF00002.1  | AF054568_1 transient receptor potential calcium channel 5                                                  | 359 | 2.00e-98 |
|  |  |  |  | CAC01686.1  | transient receptor potential channel 6, variant delta377-431                                               | 333 | 1.00e-90 |



Subtable 1C: Mixed Genes and Proteins

| Mouse Gene Protein       | Unigene  | Behavior                              | Human Proteins | Human Protein Name                                                                                                                                                                             | Score (bits) | E-value |
|--------------------------|----------|---------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|
| NM_011369<br>NP_035499.1 | Mm.37801 | U:(C-IR)<br>2.88<br>F:(IR-D)<br>-2.63 | NP_079021.2    | likely ortholog of mouse Shc SH2-domain binding protein 1; hypothetical protein FLJ22009                                                                                                       | 1004 0       |         |
|                          |          |                                       | AAH30699.1     | Unknown (protein for MGC:26900)                                                                                                                                                                | 1004 0       |         |
|                          |          |                                       | BAB71049.1     | unnamed protein product                                                                                                                                                                        | 1003 0       |         |
|                          |          |                                       | XP_015700.2    | similar to Shc SH2-domain binding protein 1                                                                                                                                                    | 632 0        |         |
|                          |          |                                       | BAB15208.1     | unnamed protein product                                                                                                                                                                        | 630 e-180    |         |
|                          |          |                                       | AAH00960.1     | AAH00960 Unknown (protein for IMAGE:3451160)                                                                                                                                                   | 615 e-176    |         |
|                          |          |                                       | AAG45336.1     | GE36                                                                                                                                                                                           | 230 8.00E-60 |         |
|                          |          |                                       | NP_112195.1    | chromosome 1 open reading frame 14; GE36 gene                                                                                                                                                  | 228 2.00E-59 |         |
|                          |          |                                       | AAG60617.1     | AF288398 1 C1orf14                                                                                                                                                                             | 228 2.00E-59 |         |
|                          |          |                                       | AAG60616.1     | AF288397 1 C1orf14                                                                                                                                                                             | 204 6.00E-52 |         |
| NM_015810<br>NP_056625.1 | Mm.859   | U:(C-IR)<br>2.74<br>F:(IR-D)<br>-3.23 | Q9UHN1         | DPG2_HUMAN DNA polymerase gamma subunit 2, mitochondrial precursor (Mitochondrial DNA polymerase accessory subunit) (PolG-beta) (MtPolB) (DNA polymerase gamma accessory 55 kDa subunit) (p55) | 712 0        |         |
|                          |          |                                       | AAD50382.1     | AF142992_1 DNA polymerase gamma accessory subunit                                                                                                                                              | 712 0        |         |
|                          |          |                                       | AAD56640.1     | AF177201_1 mitochondrial DNA polymerase accessory subunit precursor                                                                                                                            | 711 0        |         |
|                          |          |                                       | AAH09194.1     | AAH09194 Unknown (protein for MGC:15231)                                                                                                                                                       | 710 0        |         |
|                          |          |                                       | AAD56542.1     | AF184344 1 DNA polymerase accessory subunit precursor                                                                                                                                          | 707 0        |         |
|                          |          |                                       | NP_009146.1    | polymerase (DNA directed), gamma 2, accessory subunit; mitochondrial DNA polymerase, accessory subunit                                                                                         | 600 e-171    |         |
|                          |          |                                       | AAC51321.1     | mitochondrial DNA polymerase accessory subunit precursor                                                                                                                                       | 600 e-171    |         |
| NM_007659<br>NP_031685.1 | Mm.4761  | U:(C-IR)<br>2.72<br>F:(IR-D)<br>-2.86 | NP_001777.1    | cell division cycle 2 protein, isoform 1; cell division control protein 2 homolog; cyclin-dependent kinase 1; p34 protein kinase; cell cycle controller CDC2                                   | 577 e-164    |         |
|                          |          |                                       | P06493         | CDC2_HUMAN Cell division control protein 2 homolog (p34 protein kinase)                                                                                                                        | 577 e-164    |         |

|  |  |  |  | (Cyclin-dependent kinase 1) (CDK1)                                                                                                                                              |     |       |
|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|  |  |  |  | protein kinase (EC 2.7.1.37) cdc2                                                                                                                                               | 577 | e-164 |
|  |  |  |  | CAA28963.1 CDC2 polypeptide (CDC2) (AA 1-297)                                                                                                                                   | 577 | e-164 |
|  |  |  |  | CAA68376.1 CDC2 protein (AA 1-297)                                                                                                                                              | 577 | e-164 |
|  |  |  |  | AAH14563.1 Similar to cell division cycle 2, G1 to S and G2 to M                                                                                                                | 577 | e-164 |
|  |  |  |  | AAM34793.1 AF512554_1 cell division cycle 2, G1 to S and G2 to M                                                                                                                | 577 | e-164 |
|  |  |  |  | 1306392A gene CDC2                                                                                                                                                              | 577 | e-164 |
|  |  |  |  | NP_203698.1 cell division cycle 2 protein, isoform 2; cell division control protein 2 homolog;                                                                                  | 409 | e-114 |
|  |  |  |  | cyclin-dependent kinase 1; p34 protein kinase                                                                                                                                   |     |       |
|  |  |  |  | BAA26001.1 CDC2 delta T                                                                                                                                                         | 409 | e-114 |
|  |  |  |  | NP_001249.1 cyclin-dependent kinase 3                                                                                                                                           | 393 | e-109 |
|  |  |  |  | Q00526 CDK3_HUMAN Cell division protein kinase 3                                                                                                                                | 393 | e-109 |
|  |  |  |  | S23382 protein kinase (EC 2.7.1.37) cdk                                                                                                                                         | 393 | e-109 |
|  |  |  |  | CAA47001.1 serine/threonine protein kinase [Homo sapiens]                                                                                                                       | 393 | e-109 |
|  |  |  |  | CAA43807.1 cell division kinase. CDC2 homolog                                                                                                                                   | 390 | e-108 |
|  |  |  |  | NP_001789.2 cyclin-dependent kinase 2, isoform 1; cdc2-related protein kinase; cell division kinase                                                                             | 389 | e-108 |
|  |  |  |  | 2; p33 protein kinase                                                                                                                                                           |     |       |
|  |  |  |  | P24941 CDK2_HUMAN Cell division protein kinase 2 (p33 protein kinase)                                                                                                           | 389 | e-108 |
|  |  |  |  | A41227 protein kinase (EC 2.7.1.37) cdk2                                                                                                                                        | 389 | e-108 |
|  |  |  |  | 1KE5 A Chain A, Cdk2 Complexed With N-Methyl-4-[[{(2-Oxo-1,2-Dihydro-3h-Indol-3-Ylidene)methyl]amino}benzenesulfonamide                                                         | 389 | e-108 |
|  |  |  |  | 1KE6 A Chain A, Cyclin-Dependent Kinase 2 (Cdk2) Complexed With N-Methyl-4-[2-(7-Oxo-6,7-Dihydro-8h-[1,3]thiazolo[5,4-E]indol-8-Ylidene)hydrazino]phenyl]methanesulfonamide     | 389 | e-108 |
|  |  |  |  | 1KE7 A Chain A, Cyclin-Dependent Kinase 2 (Cdk2) Complexed With 3-[[{(2,2-Dioxido-1,3-Dihydro-2-Benzothien-5-Yl)amino]methylene}-5-(1,3-Oxazol-5-Yl)-1,3-Dihydro-2h-Indol-2-One | 389 | e-108 |
|  |  |  |  | 1KE8 A Chain A, Cyclin-Dependent Kinase 2 (Cdk2) Complexed With 4-[[{(2-Oxo-1,2-Dihydro-3h-Indol-3-Ylidene)methyl]amino}-N-(1,3-Thiazol-2-Yl)benzenesulfonamide                 | 389 | e-108 |
|  |  |  |  | 1KE9 A Chain A, Cyclin-Dependent Kinase 2 (Cdk2) Complexed With 3-[[4-({[amino(Imino)methyl]aminosulfonyl}anilino)methylene}-2-Oxo-2,3-Dihydro-1h-Indole                        | 389 | e-108 |
|  |  |  |  | 1FIN A Chain A, Cyclin A - Cyclin-Dependent Kinase 2 Complex                                                                                                                    | 389 | e-108 |

|  |  |  |  |            |                                                                                                                                  |     |       |
|--|--|--|--|------------|----------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|  |  |  |  | 1FIN       | C Chain C, Cyclin A - Cyclin-Dependent Kinase 2 Complex                                                                          | 389 | e-108 |
|  |  |  |  | 1FVV       | C Chain C, The Structure Of Cdk2CYCLIN A IN COMPLEX WITH AN OXINDOLE Inhibitor                                                   | 389 | e-108 |
|  |  |  |  | 1FVV       | A Chain A, The Structure Of Cdk2CYCLIN A IN COMPLEX WITH AN OXINDOLE Inhibitor                                                   | 389 | e-108 |
|  |  |  |  | 1HCL       | Human Cyclin-Dependent Kinase 2                                                                                                  | 389 | e-108 |
|  |  |  |  | 1HCK       | Human Cyclin-Dependent Kinase 2                                                                                                  | 389 | e-108 |
|  |  |  |  | 1F5Q       | A Chain A, Crystal Structure Of Murine Gamma Herpesvirus Cyclin Complexed To Human Cyclin Dependent Kinase 2                     | 389 | e-108 |
|  |  |  |  | 1BUH       | A Chain A, Crystal Structure Of The Human Cdk2 Kinase Complex With Cell Cycle-Regulatory Protein Cks1                            | 389 | e-108 |
|  |  |  |  | 1JSV       | A Chain A, The Structure Of Cyclin-Dependent Kinase 2 (Cdk2) In Complex With 4-[(6-Amino-4-Pyrimidinyl) Amino]benzenesulfonamide | 389 | e-108 |
|  |  |  |  | 1JVP       | P Chain P, Crystal Structure Of Human Cdk2 (Unphosphorylated) In Complex With Pkf049-365                                         | 389 | e-108 |
|  |  |  |  | 1DI8       | A Chain A, The Structure Of Cyclin-Dependent Kinase 2 (Cdk2) In Complex With 4-[3-Hydroxyanilino]-6,7-Dimethoxyquinazoline       | 389 | e-108 |
|  |  |  |  | 1FVT       | A Chain A, The Structure Of Cyclin-Dependent Kinase 2 (Cdk2) In Complex With An Oxindole Inhibitor                               | 389 | e-108 |
|  |  |  |  | 1CKP       | A Chain A, Human Cyclin Dependent Kinase 2 Complexed With The Inhibitor Purvalanol B                                             | 389 | e-108 |
|  |  |  |  | 1AQ1       | Human Cyclin Dependent Kinase 2 Complexed With The Inhibitor Staurosporine                                                       | 389 | e-108 |
|  |  |  |  | 1GIH       | A Chain A, Human Cyclin Dependent Kinase 2 Complexed With The Cdk4 Inhibitor                                                     | 389 | e-108 |
|  |  |  |  | 1G5S       | A Chain A, Crystal Structure Of Human Cyclin Dependent Kinase 2 (Cdk2) In Complex With The Inhibitor H717                        | 389 | e-108 |
|  |  |  |  | 1DM2       | A Chain A, Human Cyclin-Dependent Kinase 2 Complexed With The Inhibitor Hymenialdisine                                           | 389 | e-108 |
|  |  |  |  | 1F5Q       | C Chain C, Crystal Structure Of Murine Gamma Herpesvirus Cyclin Complexed To Human Cyclin Dependent Kinase 2                     | 389 | e-108 |
|  |  |  |  | AAA35667.1 | cdc2-related protein kinase                                                                                                      | 389 | e-108 |
|  |  |  |  | AAH03065.1 | cyclin-dependent kinase 2                                                                                                        | 389 | e-108 |
|  |  |  |  | AAM34794.1 | AF512553_1 cyclin-dependent kinase 2                                                                                             | 389 | e-108 |

|  |            |                                                                                                                  |           |
|--|------------|------------------------------------------------------------------------------------------------------------------|-----------|
|  | 1717387A   | cyclin A dependent p33 kinase:SUBUNIT=2                                                                          | 389 e-108 |
|  | 1E1X       | A Chain A, Human Cyclin Dependent Kinase 2 Complexed With The Inhibitor Nu6027                                   | 389 e-108 |
|  | 1E1V       | A Chain A, Human Cyclin Dependent Kinase 2 Complexed With The Inhibitor Nu2058                                   | 389 e-108 |
|  | 1B38       | A Chain A, Human Cyclin-Dependent Kinase 2                                                                       | 389 e-108 |
|  | 1B39       | A Chain A, Human Cyclin-Dependent Kinase 2 Phosphorylated On Thr 160                                             | 389 e-108 |
|  | 1E9H       | C Chain C, Thr 160 Phosphorylated Cdk2 - Human Cyclin A3 Complex With The Inhibitor Indirubin-5-Sulphonate Bound | 387 e-107 |
|  | 1E9H       | A Chain A, Thr 160 Phosphorylated Cdk2 - Human Cyclin A3 Complex With The Inhibitor Indirubin-5-Sulphonate Bound | 387 e-107 |
|  | 1H1P       | A Chain A, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu2058                    | 387 e-107 |
|  | 1H1P       | C Chain C, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu2058                    | 387 e-107 |
|  | 1H1Q       | A Chain A, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6094                    | 387 e-107 |
|  | 1H1Q       | C Chain C, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6094                    | 387 e-107 |
|  | 1H1R       | A Chain A, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6086                    | 387 e-107 |
|  | 1H1R       | C Chain C, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6086                    | 387 e-107 |
|  | 1H1S       | A Chain A, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6102                    | 387 e-107 |
|  | 1H1S       | C Chain C, Structure Of Human Thr160-Phospho Cdk2CYCLIN A COMPLEXED With The Inhibitor Nu6102                    | 387 e-107 |
|  | 1GY3       | A Chain A, Pcdk2CYCLIN A IN COMPLEX WITH MGADP, NITRATE AND PEPTIDE Substrate                                    | 387 e-107 |
|  | 1GY3       | C Chain C, Pcdk2CYCLIN A IN COMPLEX WITH MGADP, NITRATE AND PEPTIDE Substrate                                    | 387 e-107 |
|  | 1QMZ       | A Chain A, Phosphorylated Cdk2-Cyclin A-Substrate Peptide Complex                                                | 387 e-107 |
|  | 1QMZ       | C Chain C, Phosphorylated Cdk2-Cyclin A-Substrate Peptide Complex                                                | 387 e-107 |
|  | CAA43985.1 | cdk2                                                                                                             | 387 e-107 |

|             |          |                  |             |                                                                                                                   |           |  |
|-------------|----------|------------------|-------------|-------------------------------------------------------------------------------------------------------------------|-----------|--|
| NM_007418   | Mm.57205 | U:(C-IR)<br>2.41 | P18825      | A2AC_HUMAN Alpha-2C-adrenergic receptor (Alpha-2C adrenoceptor) (Subtype C4)                                      | 636 0     |  |
| NP_031444.1 |          | F:(IR-D)<br>-2.1 |             |                                                                                                                   |           |  |
|             |          |                  | AAG28076.1  | AF280399 1 alpha 2C adrenergic receptor                                                                           | 636 0     |  |
|             |          |                  | BAA02737.1  | alpha2CII-adrenergic receptor                                                                                     | 634 0     |  |
|             |          |                  | AAG28077.1  | AF280400 1 alpha 2C adrenergic receptor variant                                                                   | 634 0     |  |
|             |          |                  | NP_000674.1 | alpha-2C-adrenergic receptor; alpha2-AR-C4                                                                        | 601 e-171 |  |
|             |          |                  | A31237      | alpha-2C-adrenergic receptor                                                                                      | 601 e-171 |  |
|             |          |                  | AAA35513.1  | kidney alpha-2-adrenergic receptor                                                                                | 601 e-171 |  |
|             |          |                  | AAC78723.1  | alpha2-C4-adrenergic receptor                                                                                     | 601 e-171 |  |
|             |          |                  | A34169      | alpha-2A-adrenergic receptor                                                                                      | 385 e-106 |  |
|             |          |                  | AAA51665.1  | alpha-2 adrenergic receptor old gene name 'ADRA2R'                                                                | 385 e-106 |  |
|             |          |                  | NP_000672.2 | alpha-2A-adrenergic receptor; platelet type adrenoceptor, alpha-2A; alpha-2A adrenoceptor; alpha-2AAR subtype C10 | 384 e-106 |  |
|             |          |                  | P08913      | A2AA_HUMAN Alpha-2A adrenergic receptor (Alpha-2A adrenoceptor) (Alpha-2AAR subtype C10)                          | 384 e-106 |  |
|             |          |                  | AAF91441.1  | AF281308 1 alpha 2A adrenergic receptor                                                                           | 384 e-106 |  |
|             |          |                  | AAG00447.2  | adrenergic receptor alpha-2A                                                                                      | 384 e-106 |  |
|             |          |                  | AAK26743.1  | alpha-2A adrenergic receptor                                                                                      | 384 e-106 |  |
|             |          |                  | AAK51162.1  | alpha-2A adrenergic receptor                                                                                      | 384 e-106 |  |
|             |          |                  | AAK01634.1  | AF316894 1 alpha 2A adrenergic receptor                                                                           | 382 e-105 |  |
|             |          |                  | AAA51664.1  | alpha-2-adrenergic receptor old gene name 'ADRA2R'                                                                | 381 e-105 |  |
|             |          |                  | AAK01635.1  | AF316895 1 alpha 2B adrenergic receptor                                                                           | 358 2E-98 |  |
|             |          |                  | P18089      | A2AB_HUMAN Alpha-2B adrenergic receptor (Alpha-2B adrenoceptor) (Subtype C2)                                      | 355 2E-97 |  |
|             |          |                  | AAB62558.1  | alpha2B-adrenergic receptor                                                                                       | 355 2E-97 |  |
|             |          |                  | NP_000673.1 | alpha-2B-adrenergic receptor; alpha-2-adrenergic receptor-like 1                                                  | 258 4E-68 |  |
|             |          |                  | A37223      | alpha-2B-adrenergic receptor                                                                                      | 258 4E-68 |  |
|             |          |                  | AAA51666.1  | alpha-2-adrenergic receptor (alpha-2 C2) old gene name 'ADRA2RL1'                                                 | 258 4E-68 |  |
| NM_009608   | Mm.686   | U:(C-IR)<br>2.32 | NP_005150.1 | actin, alpha, cardiac muscle precursor                                                                            | 764 0     |  |
| NP_033738.1 |          | F:(C-D) -        |             |                                                                                                                   |           |  |



|  |  |                          |             |                                                                                                                                            |  |       |
|--|--|--------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------|--|-------|
|  |  | 2.42<br>F:(IR-D)<br>-5.6 |             |                                                                                                                                            |  |       |
|  |  |                          | XP 012405.3 | similar to actin, alpha, cardiac                                                                                                           |  | 764 0 |
|  |  |                          | P04270      | ACTC HUMAN Actin, alpha cardiac                                                                                                            |  | 764 0 |
|  |  |                          | ATHUC       | actin, cardiac muscle                                                                                                                      |  | 764 0 |
|  |  |                          | AAB59619.1  | alpha-cardiac actin                                                                                                                        |  | 764 0 |
|  |  |                          | AAH09978.1  | AAH09978 actin, alpha, cardiac muscle                                                                                                      |  | 764 0 |
|  |  |                          | NP 001091.1 | alpha 1 actin precursor; alpha skeletal muscle actin                                                                                       |  | 759 0 |
|  |  |                          | XP_001869.1 | similar to Chain B, The X-Ray Crystal Structure Of The Complex Between Rabbit Skeletal Muscle Actin And Latrunculin A At 2.85 A Resolution |  | 759 0 |
|  |  |                          | P02568      | ACTS HUMAN Actin, alpha skeletal muscle (Alpha-actin 1)                                                                                    |  | 759 0 |
|  |  |                          | ATHU        | actin alpha 1, skeletal muscle                                                                                                             |  | 759 0 |
|  |  |                          | AAB59376.1  | alpha-actin                                                                                                                                |  | 759 0 |
|  |  |                          | AAA60296.1  | alpha-skeletal actin precursor                                                                                                             |  | 759 0 |
|  |  |                          | AAF02694.1  | AF182035 1 skeletal muscle alpha-actin precursor                                                                                           |  | 759 0 |
|  |  |                          | AAH12597.1  | Similar to actin, alpha 1, skeletal muscle                                                                                                 |  | 759 0 |
|  |  |                          | NP 001604.1 | alpha 2 actin; alpha-cardiac actin                                                                                                         |  | 755 0 |
|  |  |                          | P03996      | ACTA_HUMAN Actin, aortic smooth muscle (Alpha-actin 2)                                                                                     |  | 755 0 |
|  |  |                          | CAA32064.1  | alpha-actin (AA 1-377)                                                                                                                     |  | 755 0 |
|  |  |                          | AAH17554.1  | AAH17554 actin, alpha 2, smooth muscle, aorta                                                                                              |  | 755 0 |
|  |  |                          | ATHUSM      | actin alpha 2, aortic smooth muscle                                                                                                        |  | 752 0 |
|  |  |                          | AAA51577.1  | alpha-actin                                                                                                                                |  | 752 0 |
|  |  |                          | NP_001606.1 | actin, gamma 2 propeptide; actin, alpha-3                                                                                                  |  | 750 0 |
|  |  |                          | P12718      | ACTH_HUMAN Actin, gamma-enteric smooth muscle (Alpha-actin 3)                                                                              |  | 750 0 |
|  |  |                          | A40261      | actin gamma, enteric smooth muscle                                                                                                         |  | 750 0 |
|  |  |                          | CAA34814.1  | gamma-actin (AA 1-376)                                                                                                                     |  | 750 0 |
|  |  |                          | BAA00546.1  | enteric smooth muscle gamma-actin                                                                                                          |  | 750 0 |
|  |  |                          | AAH12617.1  | Similar to actin, gamma 2, smooth muscle, enteric                                                                                          |  | 750 0 |
|  |  |                          | JC5818      | gamma-actin                                                                                                                                |  | 723 0 |
|  |  |                          | NP_001605.1 | actin, gamma 1 propeptide; cytoskeletal gamma-actin; actin, cytoplasmic 2                                                                  |  | 723 0 |
|  |  |                          | P02571      | ACTG_HUMAN Actin, cytoplasmic 2 (Gamma-actin)                                                                                              |  | 723 0 |
|  |  |                          | ATHUG       | actin gamma 1                                                                                                                              |  | 723 0 |

|             |          |                   |  |             |                                                                                                      |           |
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|             |          |                   |  | CAA27723.1  | gamma-actin                                                                                          | 723 0     |
|             |          |                   |  | AAA51579.1  | gamma-actin                                                                                          | 723 0     |
|             |          |                   |  | AAH00292.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH01920.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH07442.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH09848.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH10999.1  | Similar to actin, gamma 1                                                                            | 723 0     |
|             |          |                   |  | AAH12050.1  | Similar to actin, gamma 1                                                                            | 723 0     |
|             |          |                   |  | AAH15005.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH15695.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH15779.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | AAH18774.1  | actin, gamma 1                                                                                       | 723 0     |
|             |          |                   |  | NP_001092.1 | beta actin; beta cytoskeletal actin                                                                  | 722 0     |
|             |          |                   |  | P02570      | ACTB_HUMAN Actin, cytoplasmic 1 (Beta-actin)                                                         | 722 0     |
|             |          |                   |  | ATHUB       | actin beta                                                                                           | 722 0     |
|             |          |                   |  | CAA25099.1  | beta-actin                                                                                           | 722 0     |
|             |          |                   |  | AAA51567.1  | cytoplasmic beta actin                                                                               | 722 0     |
|             |          |                   |  | AAH01301.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH02409.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH04251.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH09275.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH13380.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH14861.1  | actin, beta                                                                                          | 722 0     |
|             |          |                   |  | AAH16045    | actin, beta                                                                                          | 720 0     |
|             |          |                   |  | CAA45026.1  | mutant beta-actin (beta'-actin)                                                                      | 718 0     |
| AA510875    | Mm.28984 | U:(C-IR)<br>2.21  |  | NP_004640.1 | chromosome 21 open reading frame 33; human HES1 protein, homolog to E.coli and zebrafish ES1 protein | 243 9E-65 |
| NP_613067.1 |          | F:(IR-D)<br>-2.64 |  |             |                                                                                                      |           |
|             |          |                   |  | P30042      | ES1_HUMAN ES1 protein homolog, mitochondrial precursor (Protein KNP-I) (GT335 protein)               | 243 9E-65 |
|             |          |                   |  | JC4913      | anti-sigma cross-reacting protein homolog 1 alpha precursor                                          | 243 9E-65 |
|             |          |                   |  | BAA12984.1  | KNP-Ia                                                                                               | 243 9E-65 |

|             |          |                                       |  |             |                                                                                                                                                                                      |  |     |       |
|-------------|----------|---------------------------------------|--|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-------|
|             |          |                                       |  | AAC50938.1  | GT335                                                                                                                                                                                |  | 243 | 9E-65 |
|             |          |                                       |  | AAC50937.1  | similar to E. coli SCRP27A and to zebrafish ESI                                                                                                                                      |  | 243 | 9E-65 |
|             |          |                                       |  | AAH02370.1  | ESI (zebrafish) protein, human homolog of                                                                                                                                            |  | 243 | 9E-65 |
|             |          |                                       |  | AAH03587.1  | ESI (zebrafish) protein, human homolog of                                                                                                                                            |  | 243 | 9E-65 |
|             |          |                                       |  | CAA68857.1  | HESI                                                                                                                                                                                 |  | 243 | 9E-65 |
|             |          |                                       |  | BAA95554.1  | HESI protein                                                                                                                                                                         |  | 243 | 9E-65 |
|             |          |                                       |  | BAA21138.1  | KNP-I alpha protein                                                                                                                                                                  |  | 243 | 9E-65 |
|             |          |                                       |  |             |                                                                                                                                                                                      |  |     |       |
| NM_009349   | Mm.299   | F:(C-IR)<br>-2.85<br>U:(IR-D)<br>3.02 |  | AAD04723.1  | thioether S-methyltransferase-like; similar to P40936 (PID:g731019)                                                                                                                  |  | 271 | 9E-73 |
| NP_033375.1 |          |                                       |  |             |                                                                                                                                                                                      |  |     |       |
|             |          |                                       |  | O95050      | INMT_HUMAN Indolethylamine N-methyltransferase (Aromatic alkylamine N-methyltransferase) (Indolamine N-methyltransferase)(Arylamine N-methyltransferase) (Amine N-methyltransferase) |  | 267 | 2E-71 |
|             |          |                                       |  | AAF18304.1  | AF128846 1 indolethylamine N-methyltransferase                                                                                                                                       |  | 267 | 2E-71 |
|             |          |                                       |  | AAF18306.1  | AF128848 1 indolethylamine N-methyltransferase                                                                                                                                       |  | 267 | 2E-71 |
|             |          |                                       |  | NP_006765.3 | indolethylamine N-methyltransferase; thioester S-methyltransferase-like                                                                                                              |  | 266 | 5E-71 |
|             |          |                                       |  | AAF18305.1  | AF128847 1 indolethylamine N-methyltransferase                                                                                                                                       |  | 266 | 5E-71 |
|             |          |                                       |  | AAH33813.   | Unknown (protein for IMAGE:5209218)                                                                                                                                                  |  | 266 | 5E-71 |
|             |          |                                       |  | NP_006160.1 | nicotinamide N-methyltransferase                                                                                                                                                     |  | 239 | 6E-63 |
|             |          |                                       |  | P40261      | NNMT_HUMAN Nicotinamide N-methyltransferase                                                                                                                                          |  | 239 | 6E-63 |
|             |          |                                       |  | A54060      | nicotinamide N-methyltransferase (EC 2.1.1.1)                                                                                                                                        |  | 239 | 6E-63 |
|             |          |                                       |  | AAA19904.1  | nicotinamide N-methyltransferase                                                                                                                                                     |  | 239 | 6E-63 |
|             |          |                                       |  | AAA93158.1  | nicotinamide N-methyltransferase                                                                                                                                                     |  | 239 | 6E-63 |
|             |          |                                       |  | AAH00234.1  | AAH00234 nicotinamide N-methyltransferase                                                                                                                                            |  | 239 | 6E-63 |
| NM_019813   | Mm.19016 | F:(C-IR)<br>-2.71<br>U:(IR-D)<br>2.42 |  | Q16643      | DREB_HUMAN Drebrin (Developmentally regulated brain protein)                                                                                                                         |  | 760 | 0     |
| NP_062787.1 |          |                                       |  |             |                                                                                                                                                                                      |  |     |       |
|             |          |                                       |  | JN0809      | drebrin E (clone gDbh13)                                                                                                                                                             |  | 760 | 0     |
|             |          |                                       |  | AAA16256.1  | drebrin E2                                                                                                                                                                           |  | 760 | 0     |

|             |         |                   |  |             |                                                                                                                                                                                             |  |           |
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|             |         |                   |  | BAA04480.1  | drebrin E                                                                                                                                                                                   |  | 760 0     |
|             |         |                   |  | AAH00283.1  | AAH00283 drebrin 1                                                                                                                                                                          |  | 760 0     |
|             |         |                   |  | AAH07281.1  | AAH07281 drebrin 1                                                                                                                                                                          |  | 760 0     |
|             |         |                   |  | AAH07567.1  | AAH07567 drebrin 1                                                                                                                                                                          |  | 760 0     |
|             |         |                   |  | NP_004386.2 | drebrin 1 isoform a; drebrin E; drebrin-1; drebrin E2                                                                                                                                       |  | 759 0     |
|             |         |                   |  | T14763      | hypothetical protein DKFZp434D064.1                                                                                                                                                         |  | 704 0     |
|             |         |                   |  | CAB53683.1  | hypothetical protein                                                                                                                                                                        |  | 704 0     |
|             |         |                   |  | NP_543157.1 | drebrin 1 isoform b; drebrin E; drebrin-1; drebrin E2                                                                                                                                       |  | 703 0     |
| NM_009185   | Mm.3988 | F:(C-IR)<br>-2.64 |  | NP_003026.1 | TAL1 (SCL) interrupting locus; SCL interrupting locus                                                                                                                                       |  | 1749 0    |
| NP_033211.1 |         | U:(IR-D)<br>2.51  |  |             |                                                                                                                                                                                             |  |           |
|             |         |                   |  | A41685      | SIL protein                                                                                                                                                                                 |  | 1749 0    |
|             |         |                   |  | AAA60550.1  | SIL                                                                                                                                                                                         |  | 1749 0    |
|             |         |                   |  | AAK51418.1  | SIL protein                                                                                                                                                                                 |  | 1749 0    |
|             |         |                   |  | CAB72102.1  | d18D14.1 (TAL1 (SCL) interrupting locus )                                                                                                                                                   |  | 741 0     |
| NM_009665   | Mm.7880 | F:(C-IR)<br>-2.6  |  | AAH00171.1  | S-adenosylmethionine decarboxylase 1                                                                                                                                                        |  | 630 e-180 |
| NP_033795.1 |         | U:(IR-D)<br>3.96  |  |             |                                                                                                                                                                                             |  |           |
|             |         |                   |  | NP_001625.1 | S-adenosylmethionine decarboxylase 1 precursor                                                                                                                                              |  | 628 e-179 |
|             |         |                   |  | P17707      | DCAM_HUMAN S-adenosylmethionine decarboxylase proenzyme (AdoMetDC) (SamDC) [Contains: S-adenosylmethionine decarboxylase alpha chain; S-adenosylmethionine decarboxylase beta chain]        |  | 628 e-179 |
|             |         |                   |  | DCHUDM      | adenosylmethionine decarboxylase (EC 4.1.1.50) precursor                                                                                                                                    |  | 628 e-179 |
|             |         |                   |  | AAA51716.1  | S-adenosylmethionine decarboxylase proenzyme (EC 4.1.1.50) old gene name 'AMD'                                                                                                              |  | 628 e-179 |
|             |         |                   |  | 1JL0        | B Chain B, Structure Of A Human S-Adenosylmethionine Decarboxylase Self-Processing Ester Intermediate And Mechanism Of Putrescine Stimulation Of Processing As Revealed By The H243a Mutant |  | 623 e-178 |
|             |         |                   |  | 1JL0        | A Chain A, Structure Of A Human S-Adenosylmethionine Decarboxylase Self-Processing Ester Intermediate And Mechanism Of Putrescine Stimulation Of Processing As Revealed By The H243a Mutant |  | 623 e-178 |
|             |         |                   |  | 1JEN        | A Chain A, Human S-Adenosylmethionine Decarboxylase                                                                                                                                         |  | 499 e-140 |

|                          |          |                                                         |             |                                                                 |                                                                                                                                                                          |              |
|--------------------------|----------|---------------------------------------------------------|-------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                          |          |                                                         |             | 11JEN                                                           | C Chain C, Human S-Adenosylmethionine Decarboxylase                                                                                                                      | 499 e-140    |
|                          |          |                                                         |             | 117C                                                            | A Chain A, Human S-Adenosylmethionine Decarboxylase With Covalently Bound Pyruvoyl Group And Complexed With Methylglyoxal Bis- (Guanyldihydrazone)                       | 498 e-140    |
|                          |          |                                                         |             | 1172                                                            | A Chain A, Human S-Adenosylmethionine Decarboxylase With Covalently Bound Pyruvoyl Group And Covalently Bound 5'-Deoxy-5'-[n- Methyl-N-(2-Aminooxyethyl) Amino]adenosine | 498 e-140    |
|                          |          |                                                         |             | 1179                                                            | A Chain A, Human S-Adenosylmethionine Decarboxylase With Covalently Bound Pyruvoyl Group And Covalently Bound 5'-Deoxy-5'-[(3-Hydrazinopropyl)methylamino]adenosine      | 498 e-140    |
|                          |          |                                                         |             | 117B                                                            | A Chain A, Human S-Adenosylmethionine Decarboxylase With Covalently Bound Pyruvoyl Group And Covalently Bound S-Adenosylmethionine Methyl Ester                          | 498 e-140    |
|                          |          |                                                         |             | 117M                                                            | A Chain A, Human S-Adenosylmethionine Decarboxylase With Covalently One-2'- Amidinohydrazone                                                                             | 474 e-133    |
|                          |          |                                                         |             | 117M                                                            | C Chain C, Human S-Adenosylmethionine Decarboxylase With Covalently Bound Pyruvoyl Group And Complexed With 4-Amidinoinidan-1-One-2'-Amidinohydrazone                    | 474 e-133    |
| NM_026599<br>NP_080875.1 | Mm.87428 | F:(C-IR)<br>-2.43<br>U:(IR-D)<br>2.5                    | BAB21840.1  | KIAA1749 protein                                                |                                                                                                                                                                          | 201 2.00E-51 |
|                          |          |                                                         | NP_116255.1 | hypothetical protein FLJ14957                                   |                                                                                                                                                                          | 201 2.00E-51 |
|                          |          |                                                         | BAB55415.1  | unnamed protein product                                         |                                                                                                                                                                          | 201 2.00E-51 |
| NM_009519<br>NP_033545.1 | Mm.22182 | F:(C-IR)<br>-2.4<br>U:(C-D)<br>2.09<br>U:(IR-D)<br>2.84 | NP_004617.2 | wingless-type MMTV integration site family, member 11 precursor |                                                                                                                                                                          | 680 0        |
|                          |          |                                                         | O96014      | WN11 HUMAN WNT-11 protein precursor                             |                                                                                                                                                                          | 680 0        |
|                          |          |                                                         | BAB72099.1  | WNT11                                                           |                                                                                                                                                                          | 680 0        |
|                          |          |                                                         | CAA73223.1  | WNT11                                                           |                                                                                                                                                                          | 676 0        |

|            |          |                   |  |             |                                                                                                                                                                                                   |  |           |
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|            |          |                   |  | CAA74159.1  | HWNT1                                                                                                                                                                                             |  | 676 0     |
|            |          |                   |  | BAC11683.1  | unnamed protein product                                                                                                                                                                           |  | 362 1E-99 |
|            |          |                   |  | BAC23080.1  | WNT4                                                                                                                                                                                              |  | 301 2E-81 |
|            |          |                   |  | NP_110388.2 | wingless-type MMTV integration site family, member 4 precursor; signaling protein WNT-4; WNT-4 protein precursor                                                                                  |  | 301 2E-81 |
|            |          |                   |  | P56705      | WNT4 HUMAN WNT-4 protein precursor                                                                                                                                                                |  | 301 2E-81 |
|            |          |                   |  | AAK51699.1  | AF316543 1 signaling protein WNT-4                                                                                                                                                                |  | 301 2E-81 |
|            |          |                   |  | AAG38658.1  | WNT4 precursor                                                                                                                                                                                    |  | 296 5E-80 |
|            |          |                   |  | CAB52601.1  | dJ224A6.2 (similar to Mouse Wnt-4 protein)                                                                                                                                                        |  | 295 1E-79 |
|            |          |                   |  | NP_116031.1 | wingless-type MMTV integration site family, member 5B precursor; WNT-5B protein precursor                                                                                                         |  | 262 1E-69 |
|            |          |                   |  | NP_110402.2 | wingless-type MMTV integration site family, member 5B precursor; WNT-5B protein precursor                                                                                                         |  | 262 1E-69 |
|            |          |                   |  | Q9H1J7      | WN5B HUMAN WNT-5B protein precursor                                                                                                                                                               |  | 262 1E-69 |
|            |          |                   |  | AAH01749.1  | AAH01749 Similar to wingless-related MMTV integration site 5B                                                                                                                                     |  | 262 1E-69 |
|            |          |                   |  | BAB62039.1  | WNT5B                                                                                                                                                                                             |  | 262 1E-69 |
|            |          |                   |  | NP_003383.1 | wingless-type MMTV integration site family, member 5A precursor; proto-oncogene Wnt-5A precursor; WNT-5A protein precursor                                                                        |  | 261 3E-69 |
|            |          |                   |  | P41221      | WN5A HUMAN WNT-5A protein precursor                                                                                                                                                               |  | 261 3E-69 |
|            |          |                   |  | A48914      | proto-oncogene Wnt-5A precursor                                                                                                                                                                   |  | 261 3E-69 |
|            |          |                   |  | AAA16842.1  | hWNT5                                                                                                                                                                                             |  | 261 3E-69 |
|            |          |                   |  | AAG38659.1  | WNT5b precursor                                                                                                                                                                                   |  | 255 1E-67 |
| AF294617   | Mm.19669 | F:(C-IR)<br>-2.39 |  | NP_004557.1 | 6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 3                                                                                                                                             |  | 1030 0    |
| AAG02118.1 |          | U:(IR-D)<br>2.05  |  |             |                                                                                                                                                                                                   |  |           |
|            |          |                   |  | XP_096349.2 | similar to 6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 3 (6PF-2-K/Fru-2,6-P2ASE brain/placenta-type isozyme) (IPFK-2)                                                                     |  | 1030 0    |
|            |          |                   |  | Q16875      | F263_HUMAN 6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 3 (6PF-2-K/Fru-2,6-P2ASE brain/placenta-type isozyme) (IPFK-2) [Includes: 6-phosphofructo-2-kinase ; Fructose-2,6-bisphosphatase ] |  | 1030 0    |
|            |          |                   |  | BAA08624.1  | 6-phosphofructo-2-kinase/fructose-2, 6-bisphosphatase                                                                                                                                             |  | 1030 0    |
|            |          |                   |  | AAD08818.1  | ubiquitous 6-phosphofructo-2-kinase/fructose 2,6-bisphosphatase                                                                                                                                   |  | 1030 0    |

|                          |               |                                                          |  |  |             |                                                                                                                                                                                                   |      |   |
|--------------------------|---------------|----------------------------------------------------------|--|--|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|
|                          |               |                                                          |  |  | AAI40083.1  | L77662_1 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase                                                                                                                                     | 1030 | 0 |
|                          |               |                                                          |  |  | AAH40482.1  | 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 3                                                                                                                                            | 1030 | 0 |
|                          |               |                                                          |  |  | 2208342A    | fructose 6-phosphate 2-kinase/fructose 2,6-bisphosphatase                                                                                                                                         | 1030 | 0 |
|                          |               |                                                          |  |  | AAB99795.1  | 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase                                                                                                                                              | 1028 | 0 |
|                          |               |                                                          |  |  | JC4626      | 6-phosphofructo-2-kinase (EC 2.7.1.105) / fructose-2, 6-bisphosphate 2-phosphatase (EC 3.1.3.46)                                                                                                  | 1028 | 0 |
|                          |               |                                                          |  |  | AAC62000.1  | inducible 6-phosphofructo-2-kinase/fructose 2,6-bisphosphatase                                                                                                                                    | 1005 | 0 |
|                          |               |                                                          |  |  | CAA06605.1  | 6-phosphofructo-2-kinase                                                                                                                                                                          | 699  | 0 |
|                          |               |                                                          |  |  | O60825      | F262_HUMAN 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 2 (6PF-2-K/Fru-2,6-P2ASE heart-type isozyme) (PFK-2/FBPase-2) [Includes: 6-phosphofructo-2-kinase ; Fructose-2,6-bisphosphatase ] | 697  | 0 |
|                          |               |                                                          |  |  | NP_006203.1 | 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 2; Fructose-2,6-bisphosphatase, cardiac isozyme                                                                                              | 688  | 0 |
|                          |               |                                                          |  |  | CAA06606.1  | 6-phosphofructo-2-kinase                                                                                                                                                                          | 688  | 0 |
|                          |               |                                                          |  |  | BAB19681.1  | 6-phosphofructo-2-kinase heart isoform                                                                                                                                                            | 680  | 0 |
|                          |               |                                                          |  |  | AAI99386.1  | AF470623_1 PFK2/F26DPase                                                                                                                                                                          | 680  | 0 |
|                          |               |                                                          |  |  | NP_004558.1 | 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 4                                                                                                                                            | 670  | 0 |
|                          |               |                                                          |  |  | Q16877      | F264_HUMAN 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 4 (6PF-2-K/Fru-2,6-P2ASE testis-type isozyme) [Includes: 6-phosphofructo-2-kinase ; Fructose-2,6-bisphosphatase ]                 | 670  | 0 |
|                          |               |                                                          |  |  | BAA18921.1  | 6-phosphofructo-2-kinase/fructose-2, 6-bisphosphatase                                                                                                                                             | 670  | 0 |
|                          |               |                                                          |  |  | AAD09427.1  | testis 6-phosphofructo-2-kinase/fructose 2,6-bisphosphatase                                                                                                                                       | 670  | 0 |
|                          |               |                                                          |  |  | AAH10269.1  | AAH10269 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 4                                                                                                                                   | 670  | 0 |
|                          |               |                                                          |  |  | JC5871      | 6-phosphofructo-2-kinase (EC 2.7.1.105) / fructose-2, 6-bisphosphate 2-phosphatase (EC 3.1.3.46)                                                                                                  | 669  | 0 |
| NM_013927<br>NP_038955.1 | Mm.10357<br>5 | F:(C-IR)<br>-2.33<br>U:(C-D)<br>3.63<br>U:(IR-D)<br>2.84 |  |  | NP_061971.2 | cyclic nucleotide gated channel beta 3; cyclic nucleotide-gated channel, beta 3                                                                                                                   | 910  | 0 |
|                          |               |                                                          |  |  | AAF86274.1  | AF272900_1 cone photoreceptor cyclic nucleotide-gated channel beta subunit                                                                                                                        | 910  | 0 |
|                          |               |                                                          |  |  | AAF80179.1  | AF228520_1 cone photoreceptor cGMP-gated cation channel beta-subunit                                                                                                                              | 773  | 0 |

|                          |                                                   |  |             |                                                                                                                                                                                               |              |  |
|--------------------------|---------------------------------------------------|--|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--|
|                          |                                                   |  | Q14028      | CNG4_HUMAN Cyclic-nucleotide-gated cation channel 4 (CNG channel 4) (CNG-4) (CNG4) (Cyclic nucleotide-gated cation channel modulatory subunit)                                                | 609 e-173    |  |
|                          |                                                   |  | AAA65620.1  | cyclic nucleotide-gated cation channel                                                                                                                                                        | 609 e-173    |  |
|                          |                                                   |  | S32538      | cGMP-gated cation channel 2, rod                                                                                                                                                              | 609 e-173    |  |
|                          |                                                   |  | AAB32607.1  | cGMP-gated cation channel subunit 2, cGMP-gated cation channel, subunit beta, hRNC2 [human, retinal rod cells, Peptide, 909 aa]                                                               | 609 e-173    |  |
|                          |                                                   |  | 1912307A    | cyclic nucleotide-gated cation channel                                                                                                                                                        | 609 e-173    |  |
|                          |                                                   |  | AAB63387.1  | cGMP-gated cation channel beta subunit                                                                                                                                                        | 609 e-173    |  |
|                          |                                                   |  | NP_001288.1 | cyclic nucleotide gated channel beta 1; cyclic nucleotide gated channel (photoreceptor), cGMP gated 3 (gamma)-like                                                                            | 609 e-173    |  |
|                          |                                                   |  | AAC04830.1  | rod photoreceptor CNG-channel beta subunit                                                                                                                                                    | 609 e-173    |  |
|                          |                                                   |  | AAA65619.1  | cyclic nucleotide-gated cation channel                                                                                                                                                        | 598 e-170    |  |
|                          |                                                   |  | S74179      | cyclic nucleotide-gated channel protein                                                                                                                                                       | 269 3.00E-71 |  |
|                          |                                                   |  | NP_001289.1 | cyclic nucleotide gated channel alpha 3                                                                                                                                                       | 269 3.00E-71 |  |
|                          |                                                   |  | Q16281      | CNG3_HUMAN Cyclic-nucleotide-gated cation channel alpha 3 (CNG channel alpha 3) (CNG-3) (CNG3) (Cyclic nucleotide gated channel alpha 3) Cone photoreceptor cGMP-gated channel alpha subunit) | 269 3.00E-71 |  |
|                          |                                                   |  | AAC17440.1  | cone photoreceptor cGMP-gated channel alpha subunit                                                                                                                                           | 269 3.00E-71 |  |
|                          |                                                   |  | NP_000078.1 | cyclic nucleotide gated channel alpha 1                                                                                                                                                       | 268 6.00E-71 |  |
|                          |                                                   |  | A42161      | cGMP-gated cation channel, rod photoreceptor                                                                                                                                                  | 268 6.00E-71 |  |
|                          |                                                   |  | AAA52010.1  | cGMP-gated cation channel protein                                                                                                                                                             | 268 6.00E-71 |  |
| NM_026302<br>NP_080578.1 | Mm.78718<br>F:(C-IR)<br>-2.21<br>U:(IR-D)<br>2.61 |  | NP_057305.1 | dynactin 4 (p62); dynactin p62 subunit                                                                                                                                                        | 886 0        |  |
|                          |                                                   |  | XP_041993.1 | similar to dynactin 4 (p62); dynactin p62 subunit                                                                                                                                             | 886 0        |  |
|                          |                                                   |  | AAF03896.1  | AF195120_1 dynactin p62 subunit                                                                                                                                                               | 886 0        |  |
|                          |                                                   |  | BAA91066.1  | unnamed protein product                                                                                                                                                                       | 886 0        |  |
|                          |                                                   |  | AAH26323.1  | dynactin 4 (p62)                                                                                                                                                                              | 883 0        |  |
|                          |                                                   |  | T47143      | hypothetical protein DKFZp761J032.1                                                                                                                                                           | 282 8.00E-76 |  |
|                          |                                                   |  | CAB82417.1  | hypothetical protein                                                                                                                                                                          | 282 8.00E-76 |  |



|             |          |                                                          |             |                                                                                                                                                                                                        |           |  |
|-------------|----------|----------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|
| NM_007755   | Mm.22062 | F:(C-IR)<br>-2.2<br>U:(IR-D)<br>2.11                     | NP_085097.2 | cytoplasmic polyadenylation element binding protein; hypothetical protein FLJ13203 similar to cytoplasmic polyadenylation element binding protein; cytoplasmic polyadenylation element-binding protein | 1039 0    |  |
| NP_031781.1 |          |                                                          | AAK01239.1  | AF329402_1 cytoplasmic polyadenylation element-binding protein long form                                                                                                                               | 1039 0    |  |
|             |          |                                                          | AAK01240.1  | AF329403_1 cytoplasmic polyadenylation element-binding protein short form                                                                                                                              | 898 0     |  |
|             |          |                                                          | AAH35348.1  | Similar to cytoplasmic polyadenylation element binding protein                                                                                                                                         | 880 0     |  |
|             |          |                                                          | BAB14496.1  | unnamed protein product                                                                                                                                                                                | 878 0     |  |
|             |          |                                                          | NP_055727.1 | KIAA0940 protein                                                                                                                                                                                       | 207 5E-53 |  |
|             |          |                                                          | BAA76784.1  | KIAA0940 protein                                                                                                                                                                                       | 207 5E-53 |  |
|             |          |                                                          | XP_047672.4 | similar to RIKEN cDNA 4930447D24                                                                                                                                                                       | 207 6E-53 |  |
|             |          |                                                          | BAB21764.1  | KIAA1673 protein                                                                                                                                                                                       | 207 6E-53 |  |
|             |          |                                                          | AAH36899.1  | Unknown (protein for MGC:46609)                                                                                                                                                                        | 207 6E-53 |  |
|             |          |                                                          | AAH36444.1  | Similar to KIAA0940 protein                                                                                                                                                                            | 203 9E-52 |  |
| NM_008422   | Mm.39092 | F:(C-IR)<br>-2.17<br>U:(C-D)<br>2.07<br>U:(IR-D)<br>2.33 | NP_004968.2 | Shaw-related voltage-gated potassium channel protein 3, Kv3.3; voltage-gated potassium channel protein Kv3.3                                                                                           | 778 0     |  |
|             |          |                                                          | Q14003      | KNC3_HUMAN Potassium voltage-gated channel subfamily C member 3 (Potassium channel Kv3.3) (KSHIID)                                                                                                     | 778 0     |  |
|             |          |                                                          | AAC24118.1  | Shaw type potassium channel Kv3.3                                                                                                                                                                      | 778 0     |  |
|             |          |                                                          | NP_004967.1 | Shaw-related voltage-gated potassium channel protein 1; voltage-gated potassium channel protein Kv3.1; potassium voltage-gated channel subfamily C member 1                                            | 612 e-175 |  |
|             |          |                                                          | P48547      | KNC1_HUMAN Potassium voltage-gated channel subfamily C member 1 (Potassium channel Kv3.1) (Kv4) (NGK2)                                                                                                 | 612 e-175 |  |
|             |          |                                                          | A46020      | potassium channel KCNC1                                                                                                                                                                                | 612 e-175 |  |
|             |          |                                                          | AAB25764.1  | voltage-gated potassium channel; NGK2                                                                                                                                                                  | 612 e-175 |  |
|             |          |                                                          | NP_004969.2 | Shaw-related voltage-gated potassium channel protein 4 isoform a; voltage-gated potassium channel protein Kv3.4                                                                                        | 571 e-162 |  |

|             |        |                           |  |             |                                                                                                                                              |      |       |
|-------------|--------|---------------------------|--|-------------|----------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|             |        |                           |  | CAC19684.1  | dJ1003J2.3.2 (potassium voltage-gated channel, Shaw-related subfamily, member 4)                                                             | 571  | e-162 |
|             |        |                           |  | Q03721      | CIKG_HUMAN Potassium voltage-gated channel subfamily C member 4 (Potassium channel Kv3.4) (KSHIIC)                                           | 571  | e-162 |
|             |        |                           |  | AAA57263.1  | potassium channel protein                                                                                                                    | 571  | e-162 |
|             |        |                           |  | NP_720198.1 | Shaw-related voltage-gated potassium channel protein 4 isoform b; voltage-gated potassium channel protein Kv3.4                              | 571  | e-162 |
|             |        |                           |  | CAC19683.1  | dJ1003J2.3.1 (potassium voltage-gated channel, Shaw-related subfamily, member 4)                                                             | 571  | e-162 |
|             |        |                           |  | NP_715624.1 | Shaw-related voltage-gated potassium channel protein 2 isoform Kv3.2c                                                                        | 556  | e-158 |
|             |        |                           |  | BAC04407.1  | unnamed protein product                                                                                                                      | 556  | e-158 |
|             |        |                           |  | NP_631875.1 | Shaw-related voltage-gated potassium channel protein 2 isoform Kv3.2b                                                                        | 556  | e-158 |
|             |        |                           |  | AAL27272.1  | AF268896 1 voltage gated potassium channel Kv3.2b                                                                                            | 556  | e-158 |
|             |        |                           |  | AAM81577.1  | potassium voltage-gated potassium channel subfamily C member 2                                                                               | 556  | e-158 |
|             |        |                           |  | NP_631874.1 | Shaw-related voltage-gated potassium channel protein 2 isoform Kv3.2a                                                                        | 556  | e-158 |
|             |        |                           |  | AAL27273.1  | AF268897 1 voltage gated potassium channel Kv3.2a                                                                                            | 556  | e-158 |
| NM_011749   | Mm.417 | F:(C-IR)                  |  | Q9UQR1      | Z148_HUMAN Zinc finger protein 148 (Zinc finger DNA binding protein 89) (Transcription factor ZBP-89)                                        | 1460 | 0     |
| NP_035879.1 |        | -2.05<br>U:(IR-D)<br>2.34 |  |             |                                                                                                                                              |      |       |
|             |        |                           |  | AAC39926.1  | zinc finger DNA binding protein 89 kDa                                                                                                       | 1460 | 0     |
|             |        |                           |  | AAL99917.1  | AF432210 1 CLL-associated antigen KW-10                                                                                                      | 1458 | 0     |
|             |        |                           |  | NP_068799.1 | zinc finger protein 148 (pHZ-52); zinc finger protein 148 (pHZ-52), BERF-1, ZBP-89                                                           | 1455 | 0     |
|             |        |                           |  | CAA15422.1  | ZBP-89 protein                                                                                                                               | 1455 | 0     |
|             |        |                           |  | A54693      | CACCC box-binding protein ht-beta                                                                                                            | 744  | 0     |
|             |        |                           |  | AAA36664.1  | CACCC box-binding protein                                                                                                                    | 743  | 0     |
|             |        |                           |  | AAH35591.1  | Similar to zinc finger protein 148 (pHZ-52)                                                                                                  | 714  | 0     |
|             |        |                           |  | AAB57692.1  | zinc finger binding protein homolog                                                                                                          | 695  | 0     |
|             |        |                           |  | CAB70967.1  | zinc finger protein                                                                                                                          | 371  | e-102 |
|             |        |                           |  | NP_036614.1 | zinc finger protein 281; ZNP-99 transcription factor                                                                                         | 371  | e-102 |
|             |        |                           |  | Q9Y2X9      | Z281_HUMAN Zinc finger protein 281 (Zinc finger DNA binding protein 99) (Transcription factor ZBP-99) (GC-box-binding zinc finger protein 1) | 371  | e-102 |

|                          |                                                                      |             |                                                                                     |           |
|--------------------------|----------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|-----------|
|                          | JC7089                                                               |             | zinc finger binding protein-99                                                      | 371 e-102 |
|                          | AAD21084.1                                                           |             | zinc finger DNA binding protein 99                                                  | 371 e-102 |
|                          | CAB70968.1                                                           |             | zinc finger protein                                                                 | 371 e-102 |
| NM_030566<br>NP_085043.1 | Mm.35467<br>F:(C-IR)<br>-2.05<br>U:(C-D)<br>2.62<br>U:(IR-D)<br>2.1  | NP_079092.1 | Fos-related antigen                                                                 | 621 e-177 |
|                          |                                                                      | BAB15594.1  | unnamed protein product                                                             | 621 e-177 |
|                          |                                                                      |             |                                                                                     |           |
|                          |                                                                      |             |                                                                                     |           |
| NM_026334<br>NP_080610.1 | Mm.46408<br>F:(C-IR)<br>-2.04<br>U:(C-D)<br>2.14<br>U:(IR-D)<br>2.27 | NP_004181.1 | lipase, gastric                                                                     | 663 0     |
|                          |                                                                      | P07098      | LIPG_HUMAN Triacylglycerol lipase, gastric precursor (Gastric lipase) (GL)          | 663 0     |
|                          |                                                                      | S07145      | triacylglycerol lipase (EC 3.1.1.3) precursor, gastric                              | 663 0     |
|                          |                                                                      | CAA29413.1  | gastric lipase precursor                                                            | 663 0     |
|                          |                                                                      | CAA29414.1  | gastric lipase precursor                                                            | 657 0     |
|                          |                                                                      | IHLG        | A Chain A, Crystal Structure Of Human Gastric Lipase                                | 635 0     |
|                          |                                                                      | IHLG        | B Chain B, Crystal Structure Of Human Gastric Lipase                                | 635 0     |
|                          |                                                                      | G01416      | lysosomal acid lipase                                                               | 474 e-133 |
|                          |                                                                      | AAB60328.1  | lysosomal acid lipase                                                               | 474 e-133 |
|                          |                                                                      | CAA83495.1  | lysosomal acid lipase                                                               | 474 e-133 |
|                          |                                                                      | AAH12287.1  | AAH12287 Similar to lipase A, lysosomal acid, cholesterol esterase (Wolman disease) | 474 e-133 |
|                          |                                                                      | S41408      | lysosomal acid lipase (EC 3.1.1.-) / sterol esterase (EC 3.1.1.13) precursor        | 474 e-133 |
|                          |                                                                      | CAA54026.1  | lysosomal acid lipase; sterol esterase                                              | 474 e-133 |

|  |  |  |  |             |                                                                                                                                                                        |     |       |
|--|--|--|--|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|
|  |  |  |  | AAB60327.1  | lysosomal acid lipase/cholesteryl ester hydrolase                                                                                                                      | 474 | e-133 |
|  |  |  |  | NP_000226.1 | lipase A precursor; Lipase A, lysosomal acid, cholesterol esterase                                                                                                     | 474 | e-133 |
|  |  |  |  | P38571      | LICH_HUMAN Lysosomal acid lipase/cholesteryl ester hydrolase precursor (LAL)<br>(Acid cholesteryl ester hydrolase) (Sterol esterase) (Lipase A) (Cholesteryl esterase) | 474 | e-133 |
|  |  |  |  | AAA59519.1  | lysosomal acid lipase/cholesteryl esterase                                                                                                                             | 474 | e-133 |
|  |  |  |  | XP_089555.2 | similar to bA30415.1 (novel lipase)                                                                                                                                    | 433 | e-121 |
|  |  |  |  | XP_061222.1 | similar to Triacylglycerol lipase, gastric precursor (Gastric lipase) (GL)                                                                                             | 431 | e-121 |
|  |  |  |  | CAC78754.1  | bA30415.1 (novel lipase)                                                                                                                                               | 428 | e-119 |

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CLAIMS

1. A method of protecting a human subject from progression from a normoinsulinemic state to a hyperinsulinemic state, or from either to a type II diabetic state, which comprises administering to the subject a protective amount of an agent which is

(1) a polypeptide which is substantially structurally identical or conservatively identical in sequence to a reference protein which is selected from the group consisting of mouse and human proteins set forth in master table 1, subtables 1A and 1C,

or

(2) an expression vector encoding the polypeptide of (1) above and expressible in a human cell, under conditions conducive to expression of the polypeptide of (1);

where said agent protects said subject from progression from a normoinsulinemic state to a hyperinsulinemic state, or from either to a type II diabetic state.

2. A method of protecting a human subject from progression from a normoinsulinemic state to a hyperinsulinemic state, or from either to a type II diabetic state which comprises administering to the subject a protective amount of an agent which is

(1) an antagonist of a polypeptide, occurring in said subject, which is substantially structurally identical or conservatively identical in sequence to a reference protein which is selected from the group consisting of mouse and human proteins set forth in master table 1, subtable 1B and 1C, or

(2) an anti-sense vector which inhibits expression of said



polypeptide in said subject,

where said agent protects said subject from progression from a normoinsulinemic state to a hyperinsulinemic state, or  
5 from either to a type II diabetic state.

3. A method of screening for human subjects who are prone to progression from a normoinsulinemic state to a hyperinsulinemic state, or from either to a type II diabetic  
10 state, which comprises assaying tissue or body fluid samples from said subjects to determine the level of expression of a "favorable" human marker gene, said human marker gene encoding a human protein which is substantially structurally identical or conservatively identical in sequence to a  
15 reference protein which is selected from the group consisting of mouse and human proteins set forth in master table 1, subtables 1A and 1C,

and directly correlating the level of expression of said  
20 marker gene with the propensity to progression in said patient.

4. A method of screening for human subjects who have a propensity for progression from a normoinsulinemic state to  
25 a hyperinsulinemic state, or from either to a type II diabetic state, which comprises assaying tissue or body fluid samples from said subjects to determine the level of expression of an "unfavorable" human marker gene, said human marker gene encoding a human protein which is  
30 substantially structurally identical or conservatively identical in sequence to a reference protein which is selected from the group consisting of mouse and human proteins set forth in master table 1, subtable 1B and 1C, and inversely correlating the level of expression of said  
35 marker gene with the propensity to progression in said patient.

5. The method of claims 1 or 3 in which the reference

protein is of subtable 1A.

6. The method of claims 1 or 3 in which the reference protein is of subtable 1B.

5

7. The method of claim 3 or 4 in which the sample is a muscle tissue sample.

10

8. The method of any one of claims 1-7 in which the reference protein is a human protein.

9. The method of any one of claims 1-7 in which the reference protein is a mouse protein.

15

10. The method of any one of claims 3 or 4 in which the level of expression of the marker protein is ascertained by measuring the level of the corresponding messenger RNA.

20

11. The method of any one of claims 3 or 4 in which the level of expression is ascertained by measuring the level of a protein encoded by said marker gene.

25

12. The method of any one of claims 1-9 in which said polypeptide is at least 80% identical or at least highly conservatively identical to said reference protein.

13. The method of any one of claims 1-10 in which said polypeptide is at least 90% identical to said reference protein.

30

14. The method of any one of claims 1-11 in which said polypeptide is identical to said reference protein.

35

15. The method of any one of claims 1-14 in which the E-value cited for the reference protein in Master Table 1 is not more than  $e^{-6}$ .

16. The method of claim 15 in which the E-value cited for the reference protein in Master Table 1 is less than  $e^{-10}$ .

17. The method of claim 17 in which the E value calculated by BLASTN or BLASTX would be less than e-15, more preferably less than e-20, still more preferably less than e-40, even  
5 more preferably less than e-60, considerably more preferably less than e-80, and most preferably less than e-100.

18. The method of any of claims 2-17 in which the antagonist is an antibody, or an antigen-specific binding fragment of  
10 an antibody.

19. The method of any of claims 2-17 in which the antagonist is a peptide, peptoid, nucleic acid, or peptide nucleic acid oligomer.  
15

20. The method of any of claims 2-17 in which the antagonist is an organic molecule with a molecular weight of less than 500 daltons.

21. The method of claim 20 in which said organic molecule is identifiable as a molecule which binds said polypeptide by  
20 screening a combinatorial library.

22. The method of claim 1 or 2 in which the agent is  
25 delivered systemically.

23. The method of claim 1 or 2 in which the agent is selectively delivered to muscle tissue.

**ABSTRACT OF THE DISCLOSURE**

Mouse genes differentially expressed in comparisons of normal vs. hyperinsulinemic, hyperinsulinemic vs. type 2 diabetic, and normal vs. type 2 diabetic muscle by gene chip analysis have been identified, as have corresponding human genes and proteins. The human molecules, or antagonists thereof, may be used for protection against hyperinsulinemia or type 2 diabetes, or their sequelae.

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